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The increasing need for skilled agricultural technicians for the grain, feed, seed, and farm supply industry resulted in preparation of this suggested curriculum guide to aid in planning, developing, and evaluating post-high school programs. The guide includes: (1) suggested course outlines with examples of texts and references, (2) sequence of technical education procedure, (3) laboratory layouts with equipment and costs, (4) a discussion of library, faculty and student services, and (5) a selected list of scientific, trade and technical societies. Consultants, advisors, owners and employers in the industry, elevator operator managers, and administrators and teachers in schools of technology provided suggestions to the agricultural and technical education specialist in the occupations section of the Division of Vocational and Technical Education who authored the document. Sections are: (1) The Grain, Feed, Seed, and Farm Supply Industry, (2) The Technician Education Program, (3) The Curriculum, (4) Course Outlines, (5) Facilities, Equipment and Cost, (6) Selecting Library Materials, and (7) Bibliography. Sample instructional materials and occupational experience forms are provided in the appendixes. (DM)

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

OE-81014

GRAIN, FEED, SEED, AND FARM SUPPLY TECHNOLOGY

A Suggested 2-Year Post High School Curriculum

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HEALTH, EDUCATION, AND WELFARE ---------------------- WILBUR J. COHEN, *Secretary*
3 Office of Education (DHEW), ---------------------- HAROLD HOWE II, *Commissioner*

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FOREWORD

THE TECHNOLOGICAL changes affecting agriculture, including farming and the agricultural businesses and industries serving the farmer, have created a need for a larger number of highly skilled technicians in the grain, feed, seed, and farm supply industry. Not only must this industry offer highly sophisticated technical services to the farmer as it provides such supplies as feeds, seeds, fertilizers, and chemicals; but also the industry must purchase, process, and distribute products of the farm through the market channels to consumers throughout the world.

This suggested curriculum guide was prepared to aid in planning and developing programs in the States to meet the Nation's increasing need for skilled technicians for the grain, feed, seed, and farm supply industry.

The guide offers suggested course outlines with examples of texts and references, sequence of technical education procedure, laboratory layouts with equipment and cost, discussion of library, faculty, and student services, and a selected list of scientific, trade, and technical societies. It is designed to assist school administrators, advisory committees, supervisors, and teachers who will be planning and developing new programs or evaluating existing programs in feed, grain, seed, and farm supply technology. Although the indicated level of instruction is post high school, the sequence of course work may well start at any grade level where students have the prerequisite background, and it may be adapted for use in training employed adults.

This guide was developed by agricultural and technical education specialists in the Occupations Section of the Division of Vocational and Technical Education, U.S. Office of Education. The basic materials were prepared by Raymond M. Clark, Professor of Education, Michigan State University, for the Grain and Feed Dealers National Association, Washington, D.C., pursuant to a contract with the Office of Education.

Many useful suggestions were received from special consultants, advisors, owners, and employers in the industry, elevator operation managers, and administrators and teachers in schools of technology. Although all suggestions could not be incorporated, each was considered carefully in the light of the publication's intended use. In view of this, it should not be inferred that the curriculum is completely endorsed by any one institution, agency, or person.

The technical accuracy of the instructional materials is due largely to the work of a group of 30 outstanding specialists in the grain and feed industry and in technical education, many of whom comprised a special advisory committee of the Grain and Feed Dealers National Association.

These persons thoroughly reviewed these materials separately or in conference with the agricultural and technical specialists of the Occupations Section.

GRANT VENN,
Associate Commissioner for Adult,
Vocational, and Library Programs

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Canton, Ill.

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Flint Hills Area Vocational-Technical School
Emporia, Kans.

Joliet Junior College
Joliet, Ill.

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Stanton, Mich.

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Walnut, Calif.

Northeastern Junior College
Sterling, Colo.

Sheridan College
Sheridan, Wyo.

State Board for Vocational Education
Agriculture Education
Des Moines, Iowa

State Board for Vocational Education
Agriculture Education
Montgomery, Ala.

State Board for Vocational Education
Agriculture Education
Springfield, Ill.

Thompson School of Applied Science
Durham, N.H.

Treasure Valley Community College
Ontario, Oreg.

Willmar Area Vocational School
Willmar, Minn.

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THE GRAIN, FEED, SEED, AND FARM SUPPLY INDUSTRY

General Considerations

The grain producing segment of the agricultural industry is a large and important component of American agriculture. Production of grain and the development and marketing of improved hybrid strains of grain is a highly sophisticated, technically oriented industry. Grain production is increasingly dependent upon scientifically applied fertilizers, herbicides to kill weeds, growth accelerators, insecticides, fungicides, and pesticides to accomplish the phenomenal output of today's scientific grain producers.

Buying, storing, transporting, selling, processing, and marketing of grains for human and animal consumption is another large part of the industry which is closely related to the production of grains.

Many of the same agencies, organizations, employers, and people involved in grain buying, marketing, and processing also are involved in supplying the farmer's need for seed, fertilizer, chemicals, pesticides, and other necessary supplies. Thus the grain, feed, seed, and farm supply industry is very large, is represented in all of the States in the Union, and is rapidly becoming more sophisticated and technical. This is a service industry which is increasingly requiring large numbers of trained technical assistants to serve in the buying, handling, and processing of grain and in the farm supply agencies. Many of these are large cooperatives, and many are independent business enterprises which buy, sell, process, and service. Because of the impact of sophisticated technology, it is increasingly necessary that technical assistants be trained in greater numbers to meet the needs of this important industry.

Figure 1.—A $200,000 country elevator where technicians will work. More than 20,000 farm supply firms—of various types, sizes, and services—are located throughout the United States.

Special Abilities Required by Technicians

Graduates of this technician curriculum can expect to find employment in many areas of the grain, feed, seed, and farm supply industry. Each of these areas may require somewhat different abilities and different specialized knowledge and skills for a successful career. Most of these abilities can be developed by continued study on the job or in part-time study. Some of the major job opportunities for the technicians are as—

(1) *Sales and Service Technicians*—technically trained members of the grain, feed, seed, and farm supply organization capable of aiding managers in purchasing, storing, displaying, selling, delivering, and servicing of products.

(2) *Manufacturers' Sales and Service Technicians*—representatives of the manufacturers and distributors of special seed and of agricultural chemicals such as fertilizers, pesticides, and herbicides. These technicians are capable of selling and servicing the special products of the manufacturers or producers to the grain, feed, seed, and farm supply organizations and, in some cases, of assisting customers with technical service.

(3) *Feed Processing and Merchandising Technicians*—capable assistants to the managers of feed compounding and processing plants. They must have an understanding of quality control of grains and other raw materials; the processing, packaging, and marketing of feed products; and the management of such operations.

Because of the urgent need for highly skilled technicians, the Grain Feed National Dealers Association (the largest of several organizations and associations concerned with the industry) undertook a contract with the U.S. Office of Education for developing this curriculum to reflect the opportunities, qualifications, and capabilities required by the technicians, and with the ultimate objective of assisting the States in initiating programs to provide an adequate supply of these skilled assistants.

In two studies, representatives of the industry were asked regarding the competencies, understandings, and abilities needed by workers in the industry. In one study,[1] representatives of the feed industry were asked to use a four point scale in rating competencies under these nine headings: processing, sales, service, office, public relations, purchase, transportation, research, and maintenance.

In the other study,[2] ratings were requested on a four-point scale from managers, assistant managers, elevator men, and clerical workers. They were asked to report the need for a number of understandings and abilities.

The two studies indicated the importance placed on a high degree of technical knowledge and skill. The need for highly trained, competent personnel for the grain, feed, seed, and farm supply industry can therefore hardly be overemphasized.

In addition to the preceding studies, members of an advisory panel participated in a 3-day meeting in which they reported on the knowledge, skills, and abilities needed by technicians in their industry.

The course outlines, laboratory recommendations, bibliographies, teacher qualifications, and other recommendations included in this publication are based on the recommendations of the advisory panel and the two studies mentioned.

The technician working in the grain, feed, seed, and farm supply industry must be capable of working and communicating directly with the managers, scientists, and operating personnel in his specialized work, of satisfactorily performing work for his employer, and of growing into positions of increasing responsibility. In addition, the graduate technician should be an active, well-informed member of society.

Technicians must have the following special abilities:

1. Proficiency in the use of the disciplined and objective scientific method in practical application of the basic principles, concepts, and laws of physics and chemistry, and/or the biological sciences as they comprise the scientific base for the individual's field of technology.
2. Facility with mathematics: ability to use algebra and trigonometry as tools to develop, define, or quantify scientific phenomena or principles; and, when needed, an understanding of, though not necessarily facility with, higher mathematics through analytical geometry, calculus, and differential equations, according to the requirements of the technology.
3. A thorough understanding and facility in use of the materials, processes, apparatus, procedures, equipment, methods, and techniques commonly used in the technology.
4. An extensive knowledge of a field of specialization with an understanding of the application of the underlying physical or biological sciences as they relate to the engineering, health, agricultural, industrial processing or research activities that distinguish the technology of the field. The degree of competency and the depth of understanding should be sufficient to enable the individual to establish effective rapport with the scientists, doctors, managers, researchers, or engineers with whom he works and to enable him to perform a variety of detailed scientific or technical work as outlined by general procedures or instructions, but requiring individual judgment, initiative, and resourcefulness in the use of techniques, handbook information, and recorded scientific data.

---

[1] Raymond M. Clark, *Vocational Competencies Needed for Employment in the Feed Industry.* (Bureau of Educational Research Services, No. 22, Michigan State University, College of Education, East Lansing, Mich. 48824) January 1965 (Mimeographed).

[2] Elwood Jackson Mabon, *Competencies in Agriculture Needed by Males in Country Elevator Grain Marketing.* (Iowa State University) 1964.

5. Communication skills that include the ability to record, analyze, interpret, and transmit facts and ideas with complete objectivity—orally, graphically, and in writing.

Activities Performed by Technicians

A list of activities, some combinations of which any technician must be prepared to perform, follows:

1. Applies knowledge of science and mathematics extensively in rendering direct technical assistance to physical and/or biological scientists, engineers, or medical personnel engaged in scientific research and experimentation.
2. Designs, develops, or plans modifications of new products, procedures, techniques, processes, or applications under the supervision of scientific, engineering, or medical personnel in applied research, design, and development.
3. Plans, supervises, or assists in installation, and inspects complex scientific apparatus, equipment, and control systems.
4. Advises regarding the operation, maintenance, and repair of complex apparatus and equipment with extensive control systems.
5. Plans production or operations as a member of the management unit responsible for efficient use of manpower, materials, money, equipment, or apparatus in mass production or routine technical service.
6. Advises, plans, and estimates costs as a field representative of a manufacturer or distributor of technical apparatus, equipment, services, and/or products.
7. Assumes responsibility for performance of tests of mechanical, hydraulic, pneumatic, electrical, or electronic components or systems in the physical sciences; and/or for determinations, tests, and/or analyses of substances in the physical, agricultural, biological, medical, or health related sciences; and prepares appropriate technical reports covering the tests.
8. Prepares or interprets engineering drawings and sketches or writes detailed scientific specifications or procedures for work related to physical and/or biological sciences.
9. Selects, compiles, and uses technical information from references such as engineering standards; handbooks; biological, agricultural, medical and health related procedural outlines; and technical digests of research findings.
10. Analyzes and interprets information obtained from precision measuring and recording instruments and/or special procedures and techniques and makes evaluations upon which technical decisions are based.
11. Analyzes and diagnoses technical problems that involve independent decisions. Judgment requires, in addition to technical know-how,

Students Learn . . . IN THE LABORATORY

FIGURE 2.—When he completes his program, this young man will be a grain, feed, and seed technician.

. . . . IN THE CLASSROOM

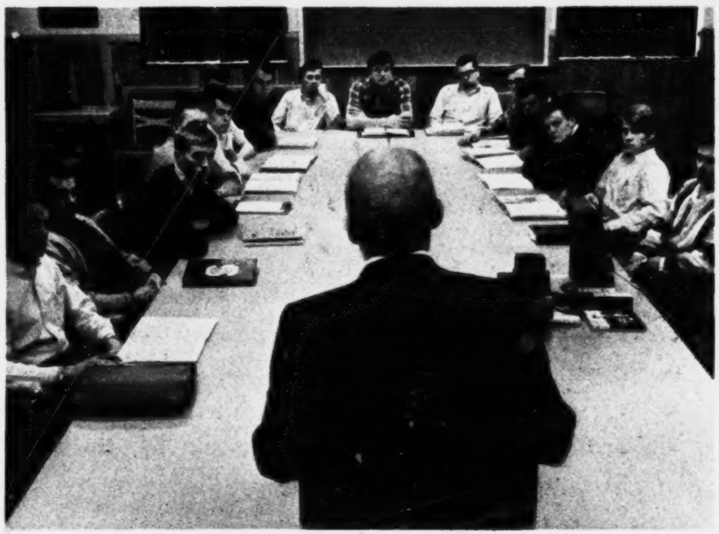

Figure 3.—Class listens to resource person from local grain, feed, and farm supply business.

. . . ON FIELD TRIPS

Figure 4.—Technician student learns about equipment.

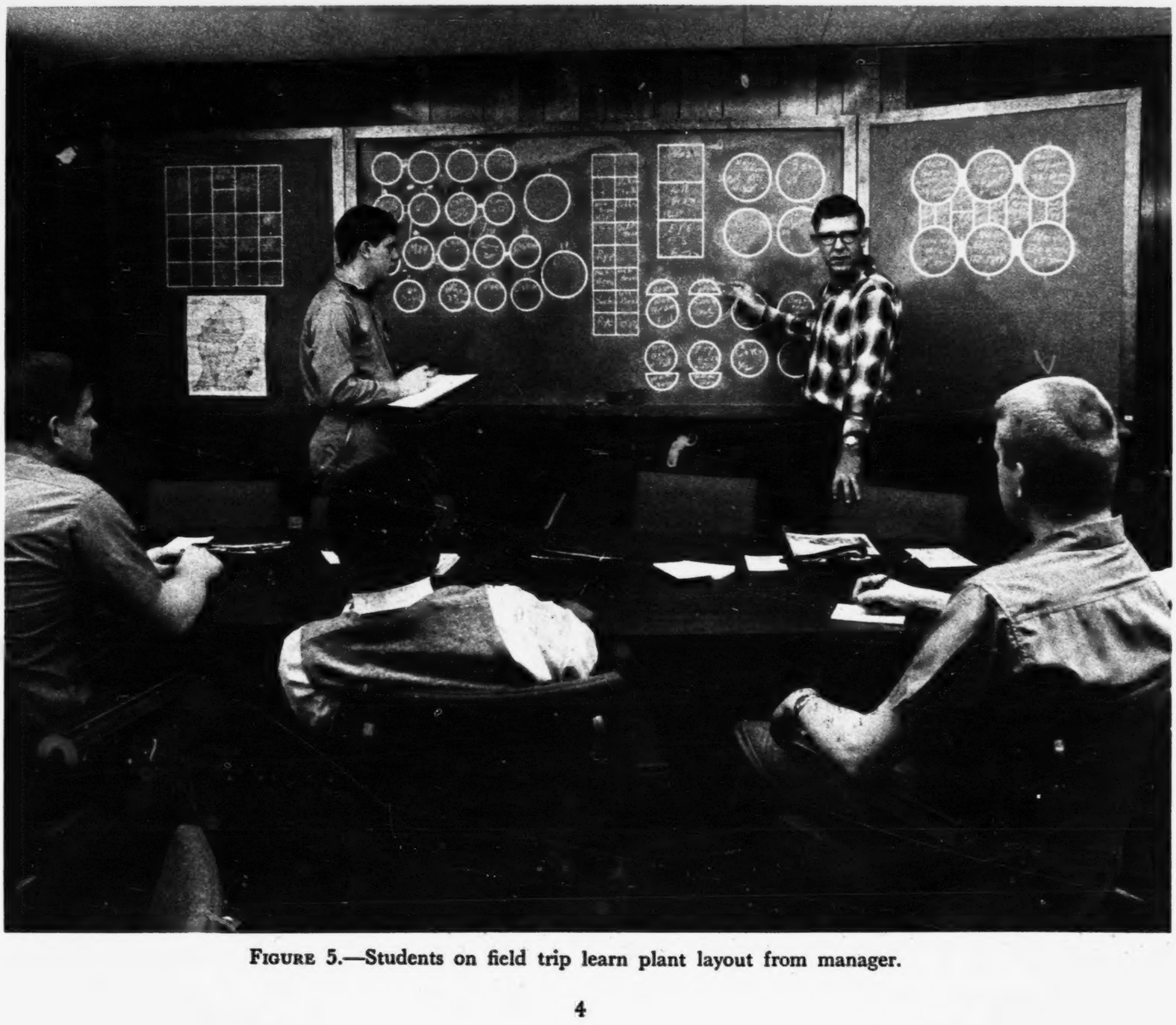

Figure 5.—Students on field trip learn plant layout from manager.

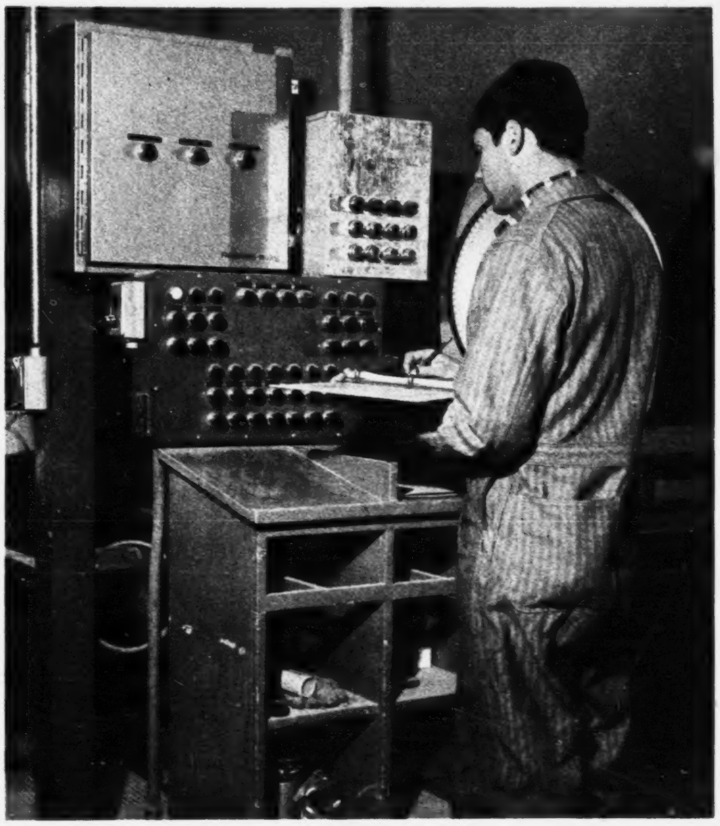

Figure 6.—Feed technician mixing feed the modern way.

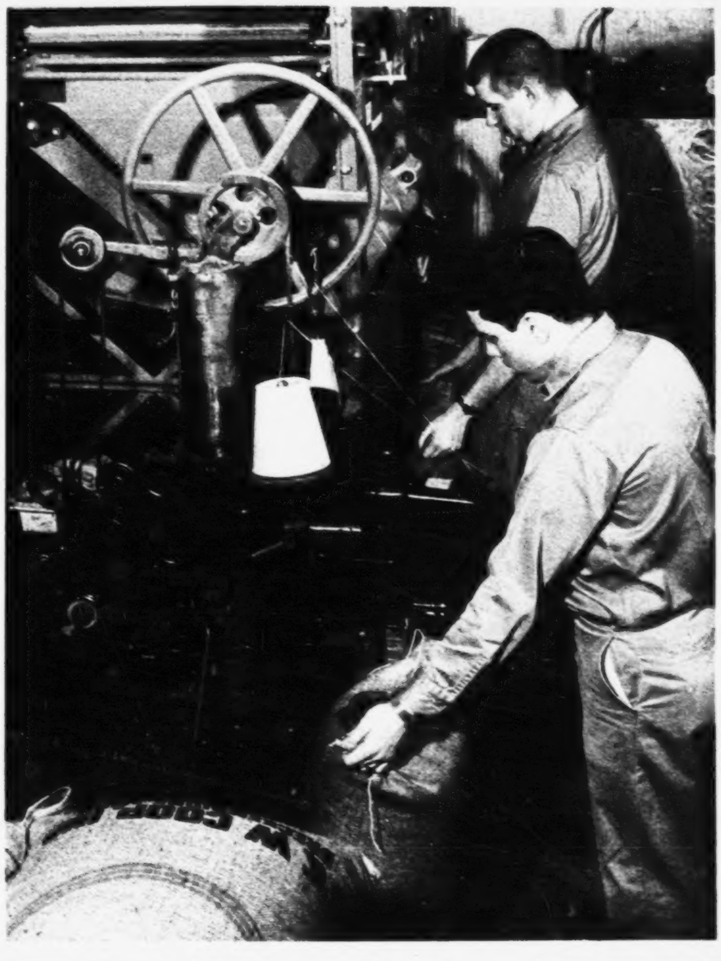

Figure 7.—Students on occupational experience bag seed.

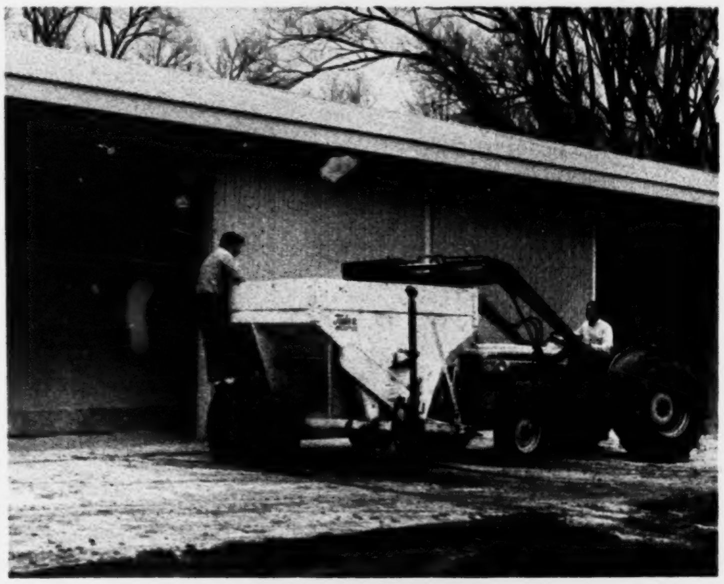

Figure 8.—It takes technical know-how to mix bulk fertilizer to specifications.

substantive experience in the occupational field.

12. Deals with a variety of technical problems involving many factors and variables which require an understanding of several technical fields. This versatility is a characteristic that relates to breadth of applied scientific and technical understanding, the antithesis of narrow specialization.

Technicians in the grain, feed, seed, and farm supply industry in a two-year post high school program will be prepared to do such tasks as:

1. Formulate and test new rations under supervision.
2. Test the performance of new varieties of seeds.
3. Grade grain, and test and label seed according to State and Federal regulations.
4. Prepare advertisements for local newspapers.
5. Prepare displays of merchandise for the farm supply center.
6. Recommend fertilizer programs based on reports of soil testing laboratories.
7. Sell seed, feed, and farm supplies either on the farm or in the farm supply center.
8. Handle grain in accordance with accepted practices in terms of sanitation, conditioning, and safety.
9. Process grain to maintain or improve grade, preserve quality, and prepare it for shipment.

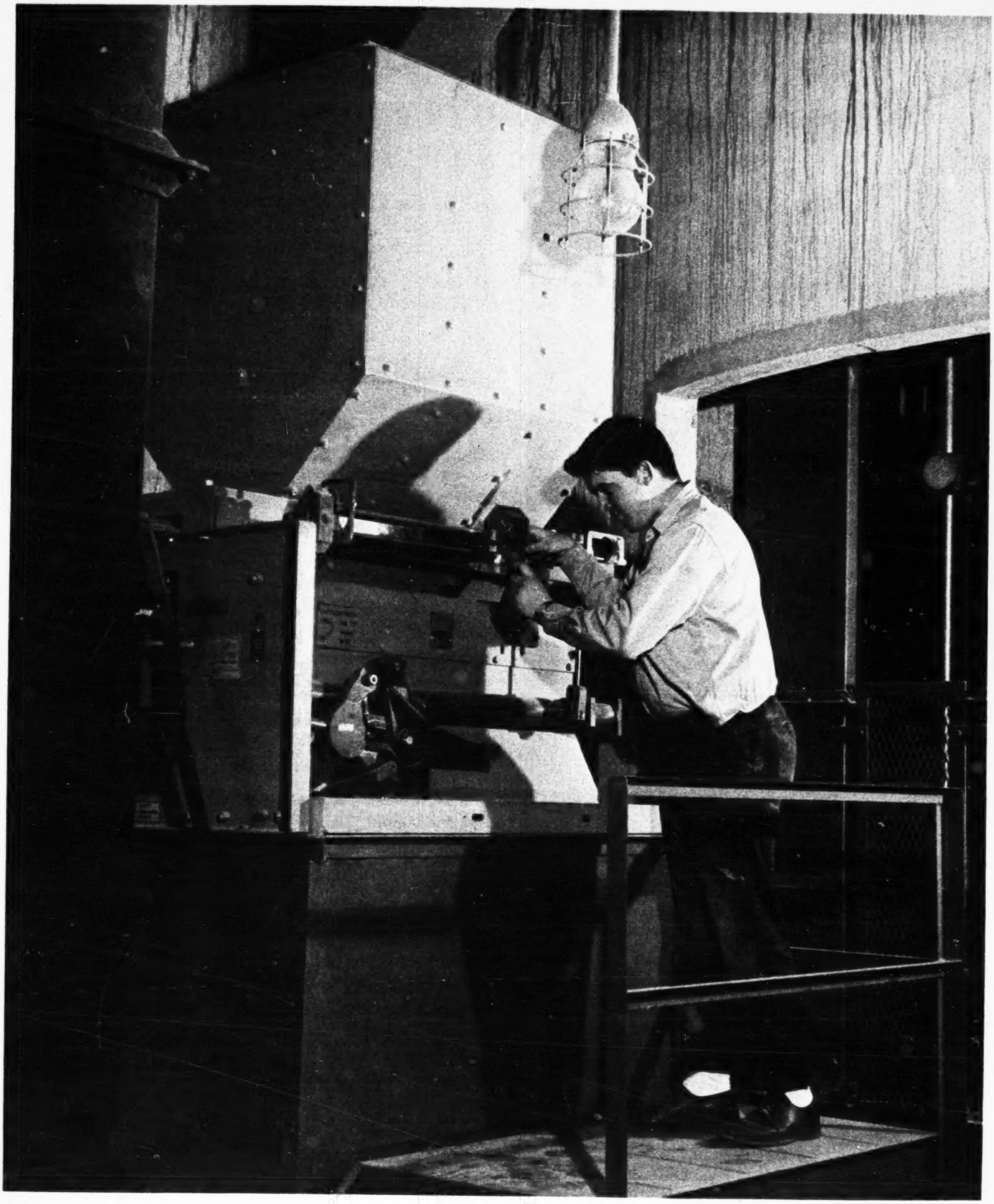

FIGURE 9.—Occupational experience provides opportunity for work with modern equipment.

10. Operate the grain handling, storage, and processing equipment in an approved manner and consistent with acceptable safety practices.
11. Direct the business operation of the plant under the policies and objectives of the manager.
12. Compute the formulation of agricultural chemicals and fertilizers needed to supply recommended applications.

Performance of such activities requires: (1) knowledge of nutrition, fertilizers, varieties, rations, and feed ingredients; (2) presenting demonstrations with grain, feed, and seeds; (3) performing demonstrations with company products; (4) selling company products and performing services for the customer in line with company policy; and (5) operating the plant and its equipment in accordance with approved practices and acceptable safety standards.

Persons trained in this program will be able to perform the technical operations of the business such as testing grain and seeds for moisture; sampling grain, seeds, and feeds; inspecting fields of seed for purchase; conditioning grain at the plant; and many other similar activities.

. . . OCCUPATIONAL EXPERIENCE

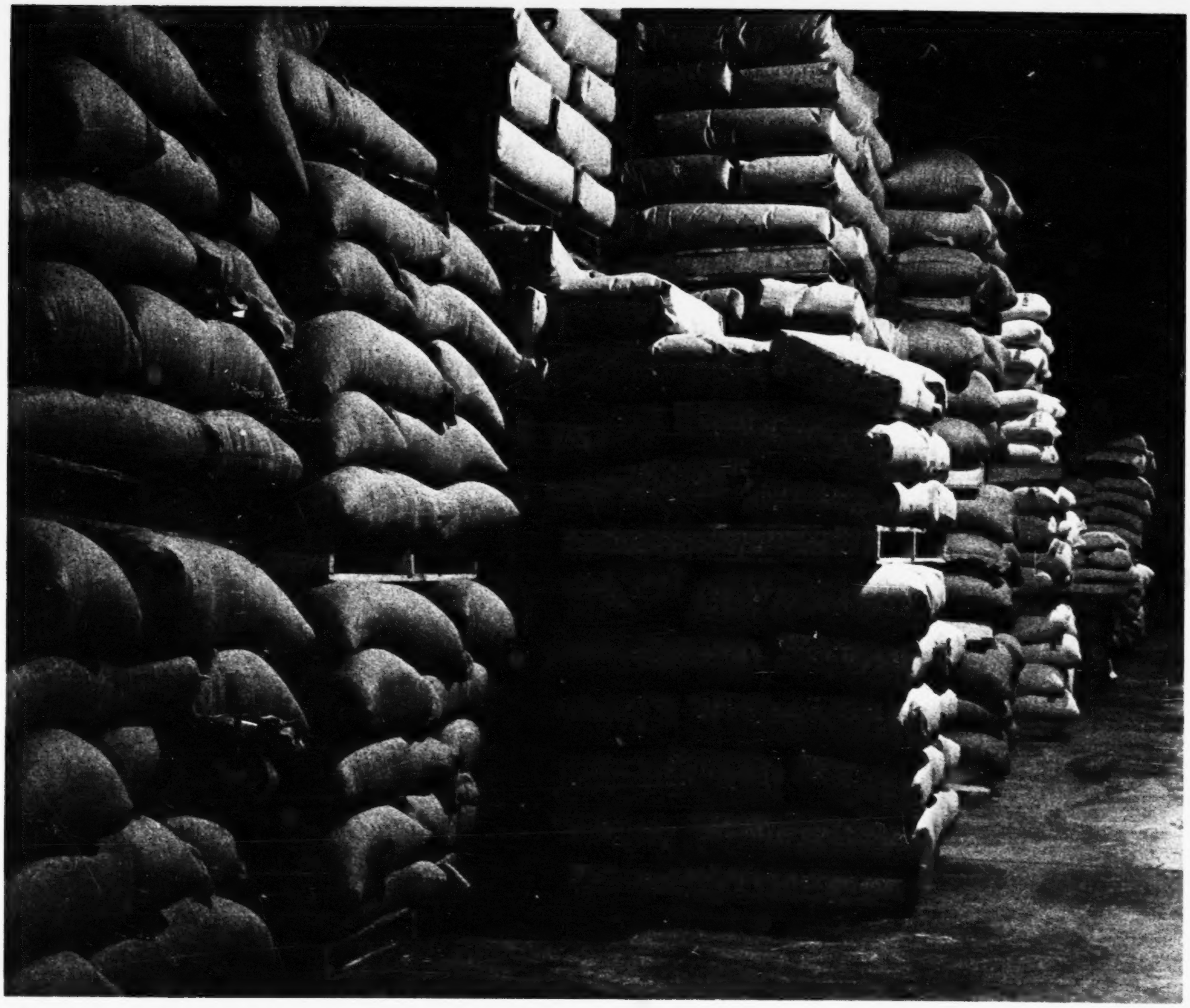

Figure 10.—Seed technicians analyzed, packaged, and stored this seed. Their work will largely determine the success of farmers who buy this seed.

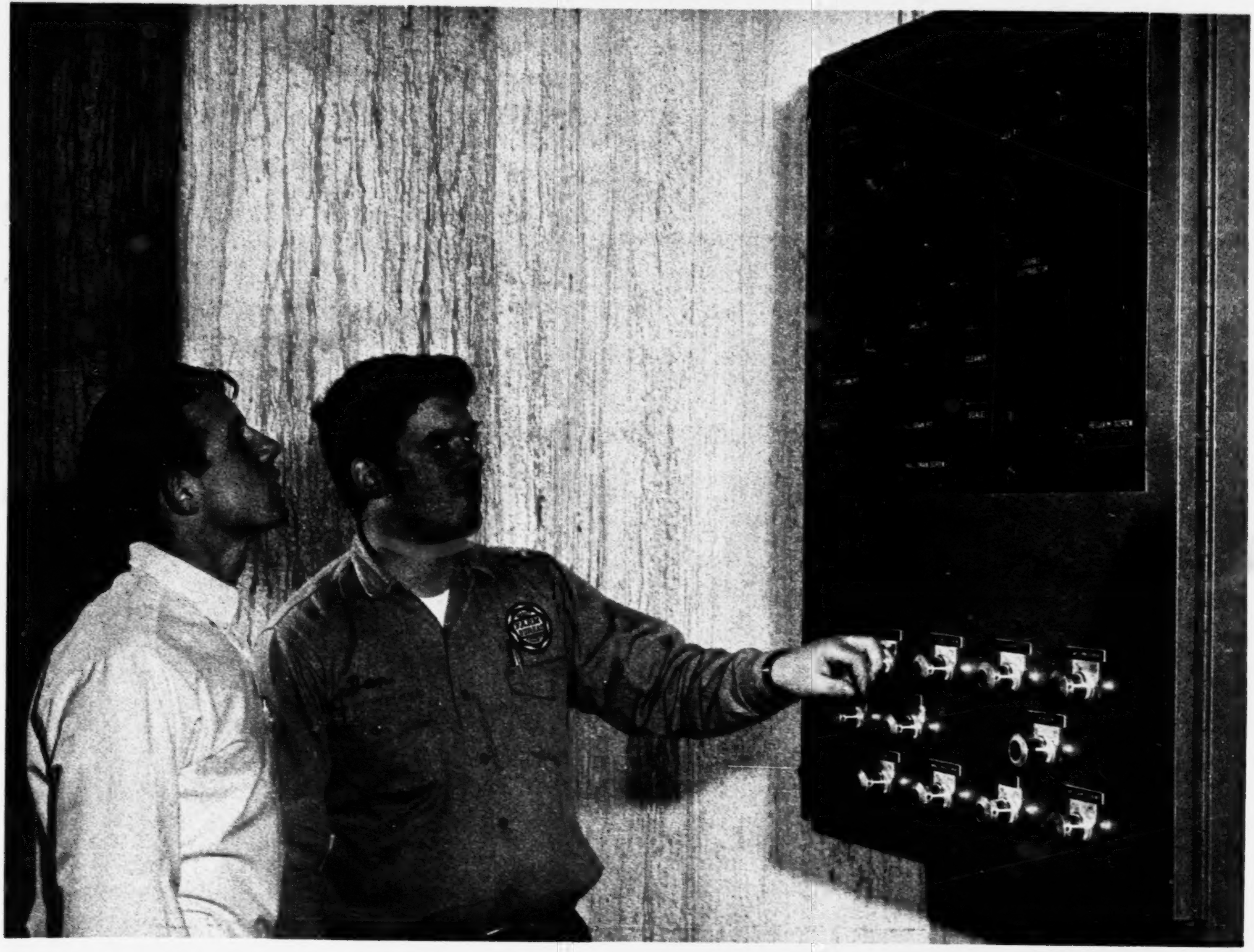

FIGURE 11.—Learning their way around, these students on occupational experience are expected to become key men in similar plants.

FIGURE 12.—Technician student on occupational experience waits on a customer.

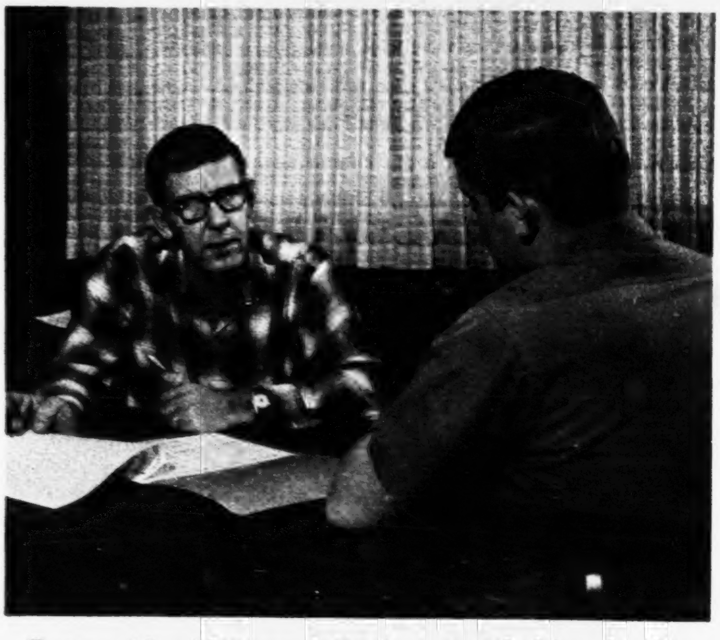

FIGURE 13.—Manager interviews a technician for his grain elevator.

WHAT STUDENTS WILL BE ABLE TO DO

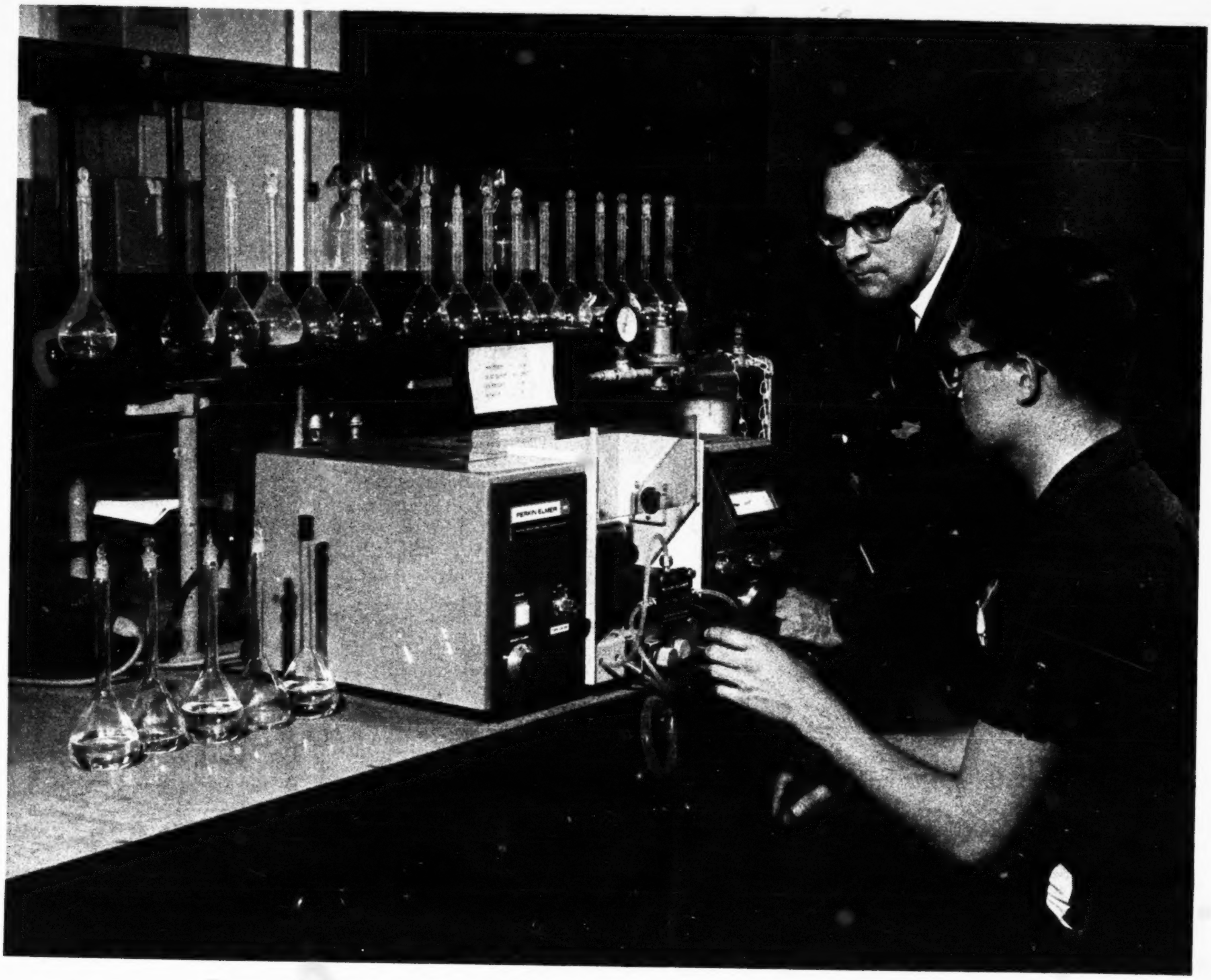

FIGURE 14.—Farm supply technician student practices with modern equipment.

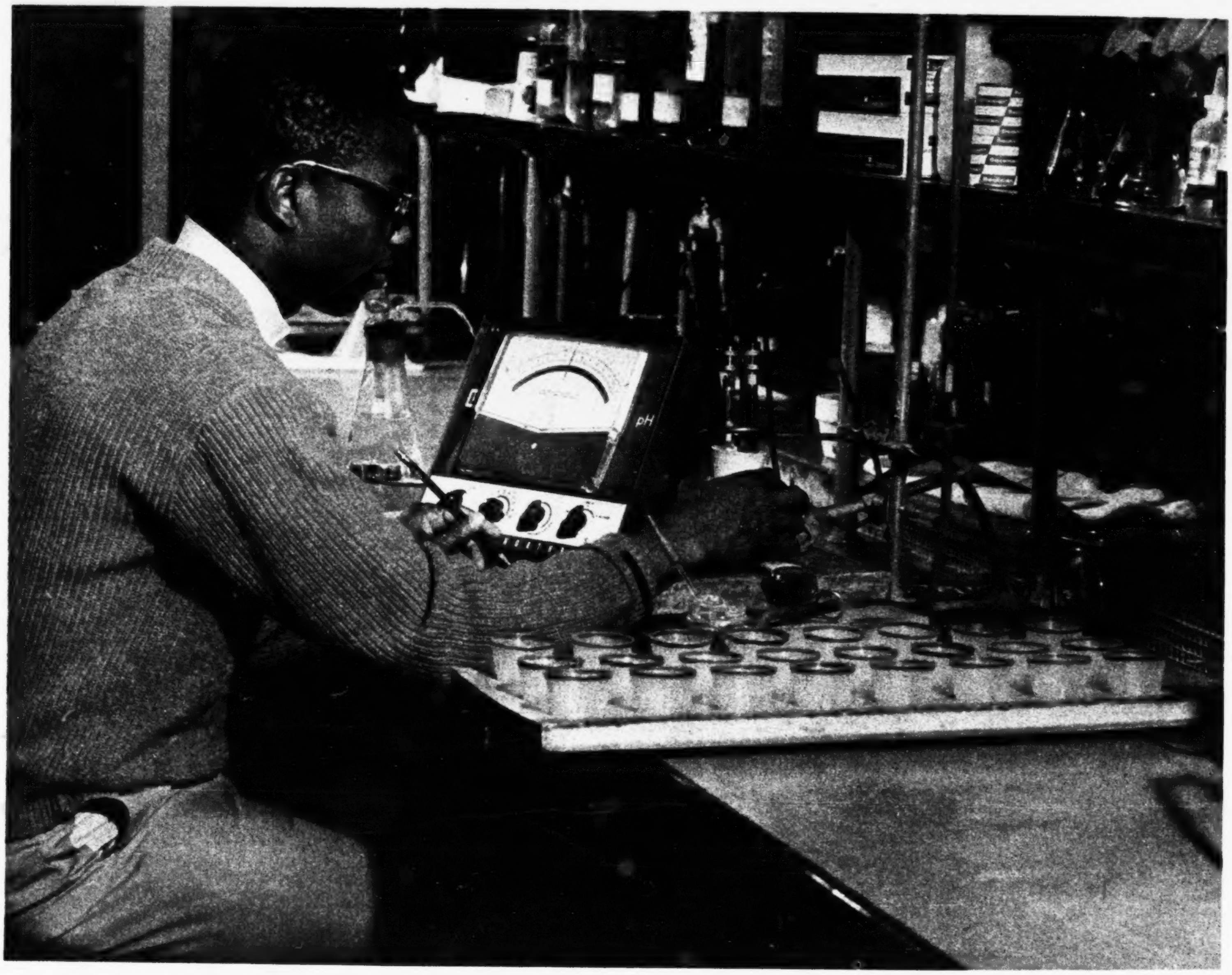

FIGURE 15.—Soil technology is essential in the farm supply business. This student tests soil for pH.

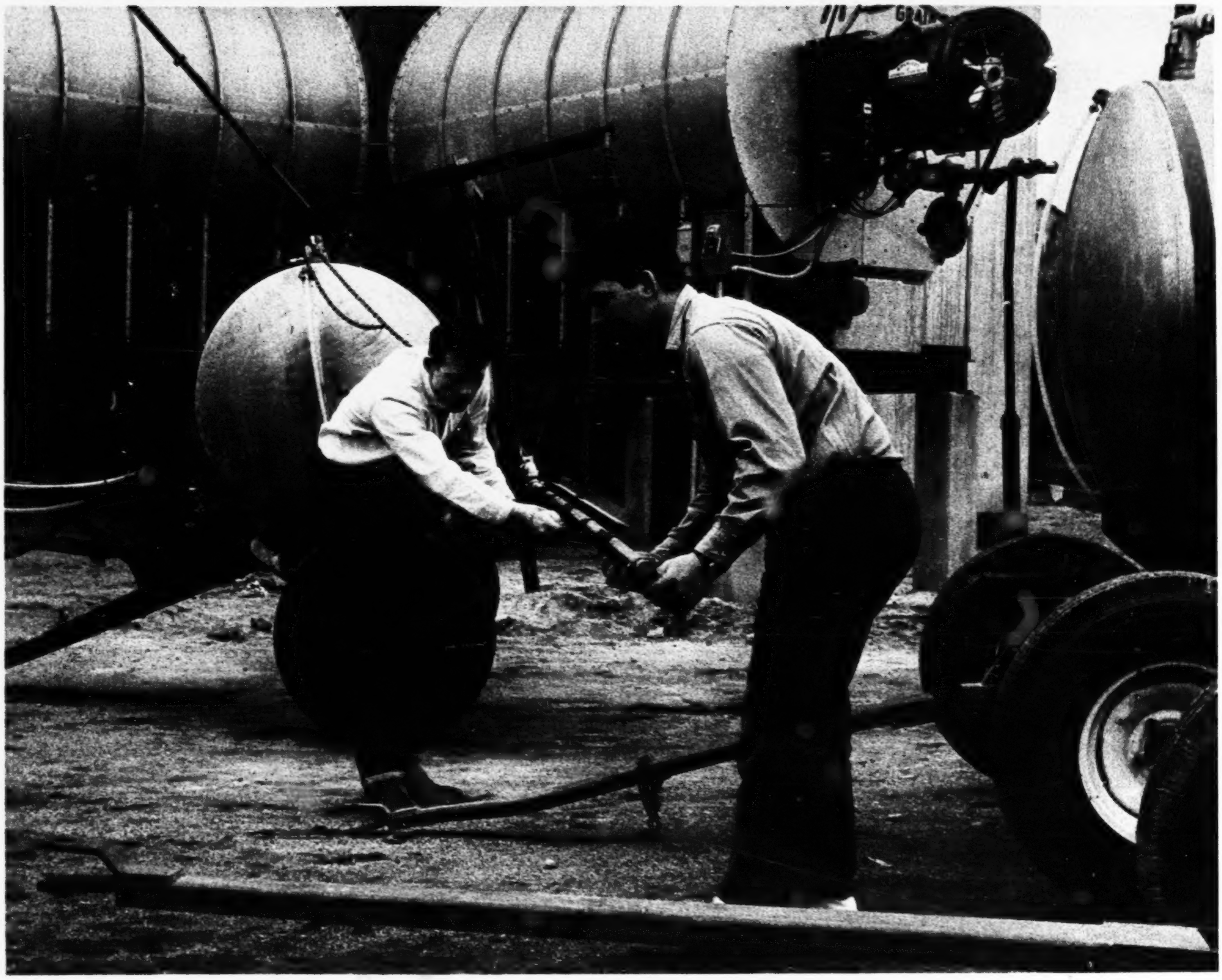

FIGURE 16.—Farm supply technician students adjust fertilizer equipment.

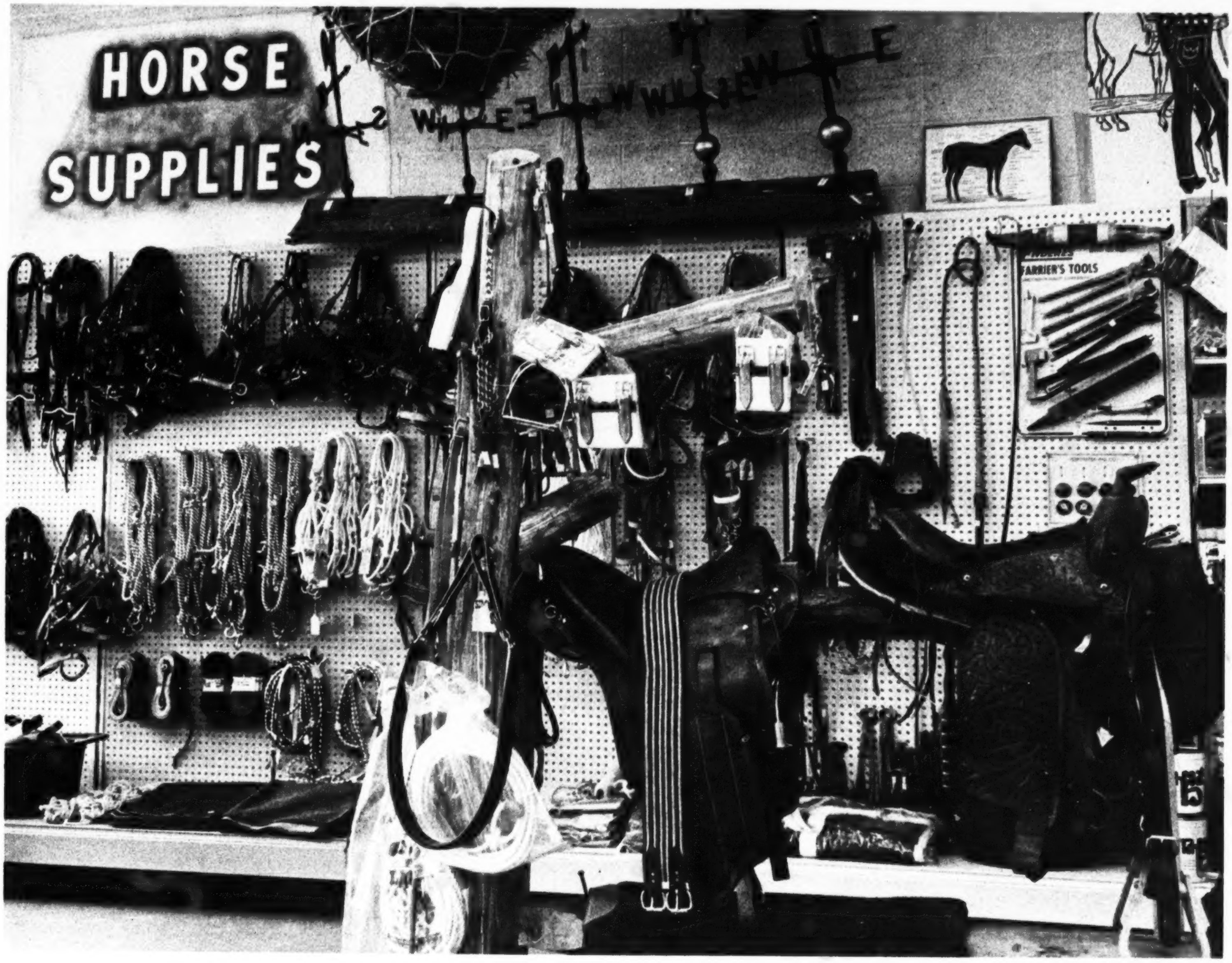
HORSE
SUPPLIES
FARRIER'S TOOLS

FIGURE 17.—Technician students built display typical of a Western ranch supply center.

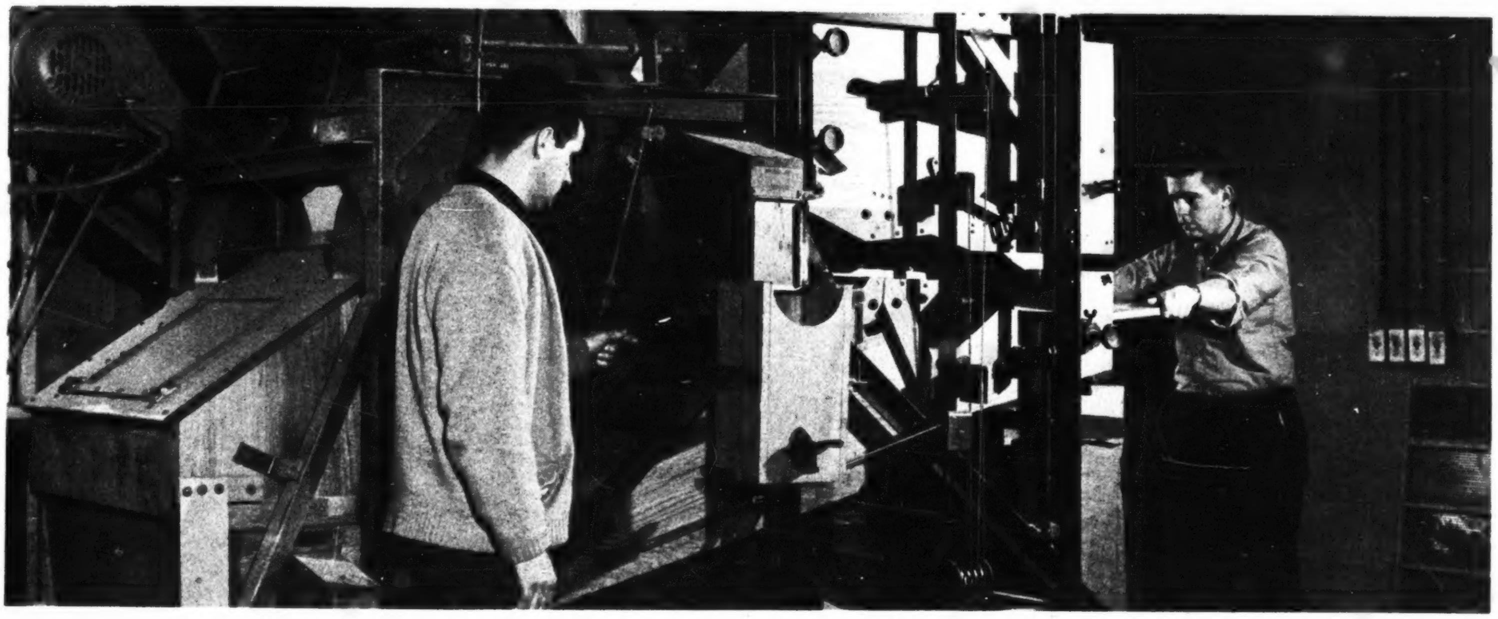

FIGURE 18.—Technician students use standard equipment in their laboratory.

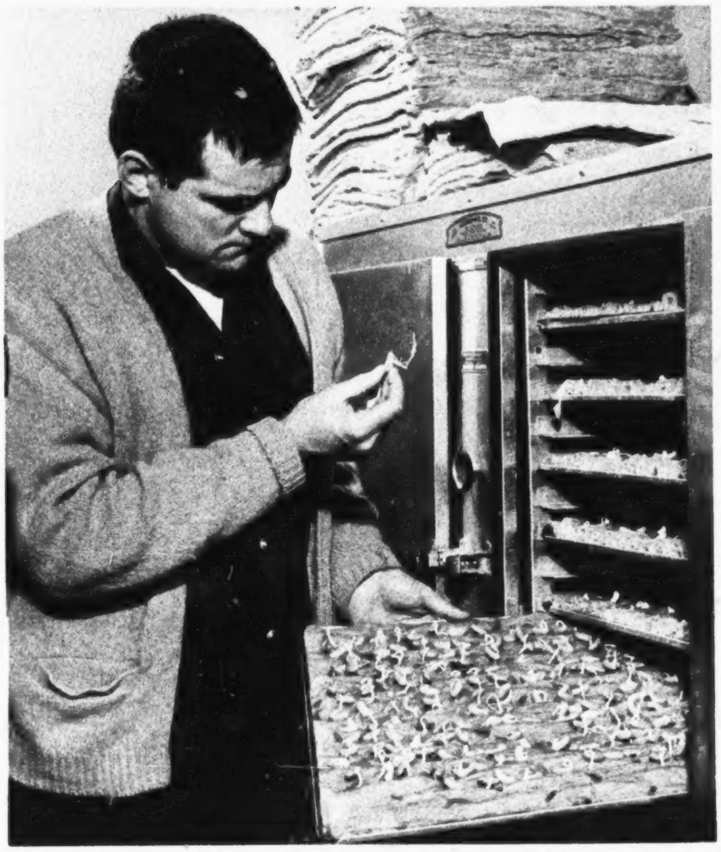

FIGURE 19.—This technician student recognizes healthy germination in seeds.

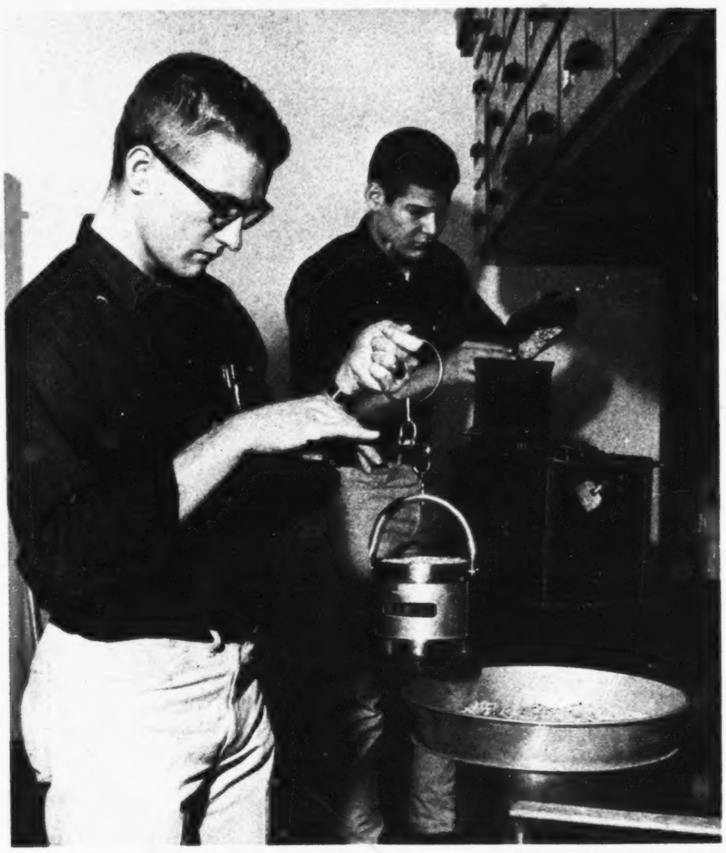

FIGURE 20.—Technicians must accept responsibility. They must be accurate in grading grain.

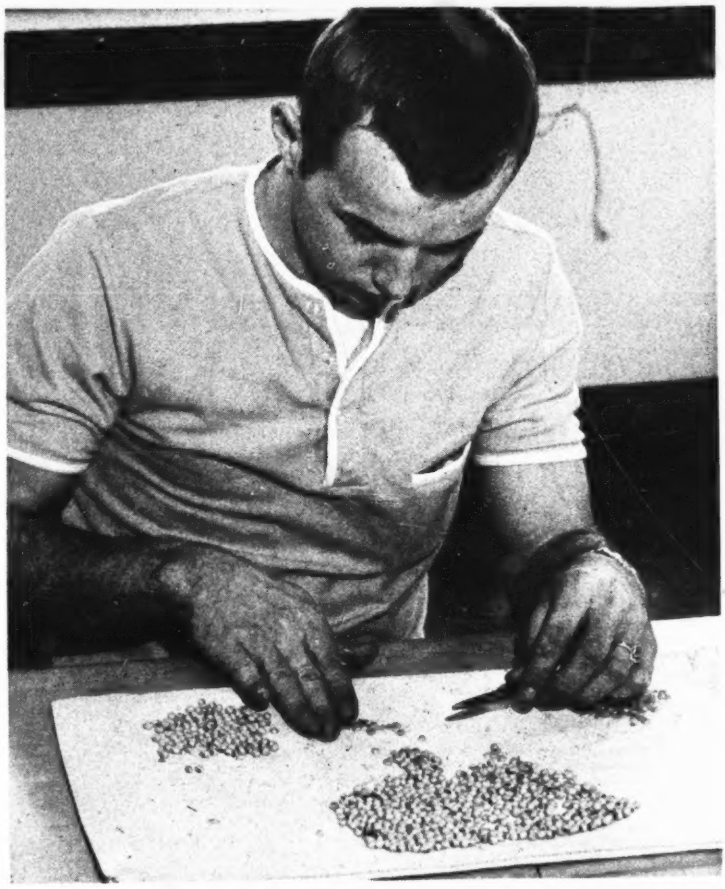

FIGURE 21.—The grade determines the price. This student will be an expert.

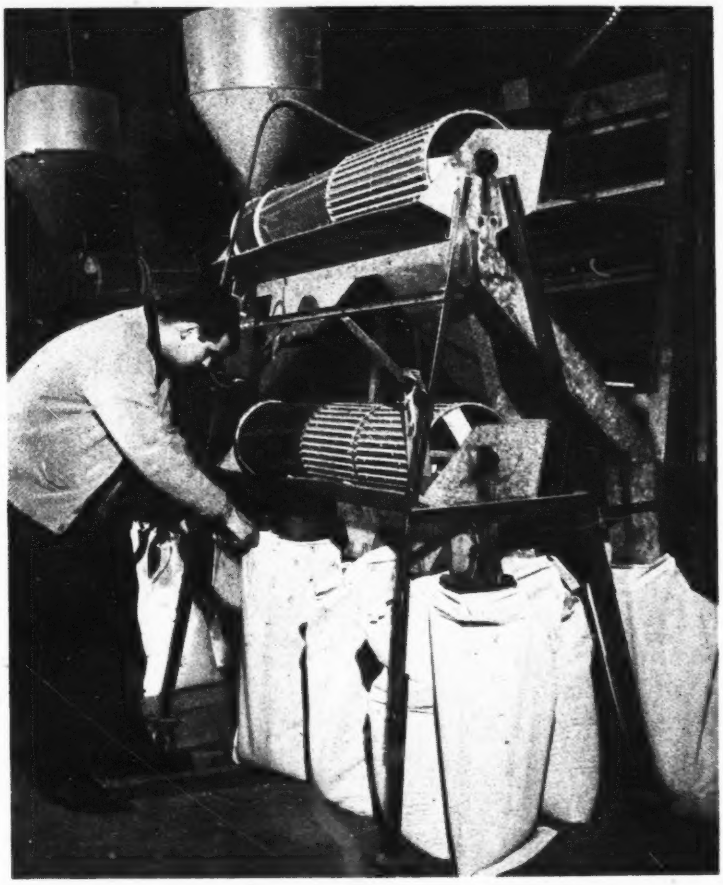

FIGURE 22.—When this man graduates, he will know how to grade and label seeds accurately.

WHAT STUDENTS WILL BE ABLE TO DO

Figure 23.—Technicians buy beans and grain. They must have excellent judgment.

Figure 24.—Student loads bulk feed truck. Students also learn to advise customers regarding feeds for livestock and poultry.

THE TECHNICIAN EDUCATION PROGRAM

Technician education programs are devoted to preparing highly specialized personnel who must be capable of performing many tasks requiring special skills, and who must be nearly professional in education, attitude, and competence. These programs provide a carefully structured, rigorous study of basic and scientific principles and supporting mathematics plus an intensive, laboratory-oriented program of instruction. This program is required to provide (1) the knowledge of applied principles, and of the materials, processes, procedures, techniques, and modern measuring and control devices; and (2) the ability to communicate with and assist the engineer or scientist engaged in research, development, production, or scientific or medical service work. The training programs are generally designed for 2 years of intensive post high school study, but many technical and some comprehensive high schools provide technical and related vocational education in this field.

This curriculum guide provides an intensive 2-year, full-time program of study for students planning to enter the grain, feed, seed, and farm supply industry at the technician level. The courses in the plan of study are designed and organized to provide a knowledge of the applied biological and physical sciences, the principles of economics and related disciplines, together with the development of skills necessary for successful performance in the industry.

Work at the technician level in the grain, feed, seed, and farm supply industry requires a broad complex of knowledge, understandings, and abilities ranging from applied biochemistry, soil science, and animal nutrition to the science and art of raising crops, livestock, and poultry. Steps in buying products from farmers and moving them through the channels of processing and trade until they reach the consumer and the steps in purchasing and distributing the supplies needed by the farmers for production and operation are included. Involved in these understandings, abilities, and skills are the principles and practices related to the biological and physical sciences; the principles of economics, distribution, and credit; as well as the principles and practices involved in the organization and operation of the business and in the management of personnel.

This 2-year curriculum concentrates on the primary need to prepare individuals for responsible technical positions in the industry. It provides for a high degree of specialization which is essential for the preparation of individuals for technical level work.

Faculty

The effectiveness of the curriculum depends to a large extent on the competence and enthusiasm of the teaching staff. It is important for instructors selected for this program to have a sound background of experience in the area of their specialty and also to be able to relate the specialized field to the needs of the students and the requirements of the industry. It is essential for students to be taught how to make application of knowledge and understanding to situations they are likely to encounter in the industry.

The problem of identifying and recruiting qualified instructors is a very real one. Some instructors will be found in industry and may be available for teaching in subject-matter areas of their specialty on a part-time basis. Present vocational or academic teachers with an understanding and appreciation of the industry may be available for the program. As programs develop, it will be necessary for teacher education institutions to undertake the training of specialized instructors for the technical aspects of the curriculum.

Qualifications of the Instructor

As nearly as possible, the faculty members needed for this program should meet the following qualifications:

1. *The instructor should be expert in the area in which he is to teach.*

If he is to prepare students for technician level work, he should be well trained in his field and be able to adjust his teaching to the needs of the pertinent occupation; for example, the instructor of *Applied Animal Nutrition* would adapt the course content to the needs of the feed industry.

2. *The instructor should be experienced in the industry for which the training is given.*

Instructors in such related subjects as animal biochemistry or communications should be able to help students make specific application of the content of these courses to the needs of technicians in the industry for which they are training.

3. *The instructor should have the ability to apply techniques of teaching.*

Students need to understand the relationship of a specific subject to the total program in which they are enrolled. Methods of presenting materials, motivating students, developing student activities, and helping them evaluate progress are all abilities required of the instructors.

It is desirable for the faculty to be skilled in the selection and use of materials which are most appropriate for instruction. Laboratory exercises, field trips, use of resource persons, and demonstrations, as well as the more common charts, filmstrips, and educational films, will be valuable aids in the training program.

The development of the personal aspects of the employee should be uppermost throughout the program, with emphasis on human relations, employer-employee relations, customer relations, and personal traits of the individual. (For specific outline, see page 138.)

The occupational experience program will be found one of the most desirable instructional devices, particularly if the program is to provide experiences which are not otherwise available to the student. To make the occupational experience most beneficial, instructors must be able to work closely with employers and students to develop a well-coordinated program.

4. *It is desirable for the instructor to possess a B.S. or M.S. degree.*

Nearly all community colleges and similar institutions have a minimum basic requirement of a bachelor's degree for their instructors. In some States, a master's degree is the basic prerequisite. Deviations may be made from this requirement for instructors in specialized vocational-technical programs where experience and knowledge of the specific business and industry are essential. For many programs, it is advisable to recruit instructors from the industry even though they may lack the suggested academic requirements.

5. *The instructor should possess a certificate to teach in the public schools of the State in which he is employed.*

States which require certificates for instructors in community colleges or universities generally issue "special certificates" for instructors of vocational-technical subjects who are recruited from industry and business on the basis of their special qualifications.

Identifying and Recruiting Instructors

Since instructors have not been prepared in subject-matter fields or in professional education programs for teaching courses for the grain, feed, seed, and farm supply industry, it is likely that the only sources of instructors in the next few years will be industry or land-grant agricultural colleges. Some individuals can be secured either "on loan" from their present assignments or by means of agreements (contracts) with their institutions to teach specified courses. Some individuals who have retired from industrial positions and who are physically and mentally alert may be recruited as part-time instructors in areas of work in which they have had successful experience.

Teachers of vocational agriculture and of vocational business courses may also be recruited as instructors. These instructors will need special help from school administrators, teacher-educators, and industry representatives to adapt their teaching to the needs of the trainees. Among this group, some will have had experience in the industry and be in a position to do an excellent job of teaching in the area.

For the related work, such as communications and animal biochemistry, the services of instructors who are well qualified in their fields may be used. These instructors should be able to present the subject-matter content particularly applicable to the grain, feed, seed, and farm supply industry.

In some situations, it will be advisable to have a team of instructors. This will be particularly true when instructors are recruited from the industry or secured by contract from a land-grant institution. For example, for a sequence of courses such as *Applied Animal Biochemistry; Applied Animal Nutrition;* and *Feeds, Ingredients, Additives, and*

Food and Drug Regulations different instructors are likely to be used. In this case, it will be necessary for one individual to coordinate the total program so that the students will be conscious of a well-organized, integrated program.

In-Service Instructor Education

Vocational-technical programs need to be kept up to date if they are to be effective. Therefore, programs of in-service education must be developed and used to help instructors keep abreast of progress.

In-service education has two major aspects:

1. To update instructors in terms of new developments in the industry.
2. To update instructors in terms of professional education.

In some cases, in-service education may be offered by experts in a field related to the grain, feed, seed, and farm supply industry, such as research workers from agricultural colleges or industry and specialists in a specific area in which instructors need help.

In other cases, in-service education may be provided by faculty members of a teacher education institution. They may be called upon to help instructors with teaching methods, use of instructional materials, planning instructional procedures, evaluation, and the like.

Coordination of in-service education programs has been recognized as a function of vocational teacher education in many States. The coordinator determines the needs of groups of instructors for in-service education, organizes a program, and carries it out with the help of appropriate specialists. In some cases, these specialists work as a team, and in other cases, they work individually with relationships among their respective tasks identified by the coordinator.

Student Selection and Services

The effectiveness and success of the program will be measured by the quality of its graduates. It is therefore essential that those who are admitted to the program have a high degree of interest and motivation. Students should show some evidence of maturity and real purpose when they apply for admission.

High School Preparation

The program is designed for high school graduates, although provision may be made for the admission of students who are not graduates of a high school. For students who are planning a 4-year high school course of study to prepare for this technician program, the following sequences of courses are suggested:

English: 3 years, with as much emphasis as possible on written and spoken communication
Mathematics: through algebra and geometry
Science: 2 years or more
Social science: 2 years
Vocational agriculture: 2 to 4 years, including an integrated program in agricultural mechanics

In addition, courses in bookkeeping, salesmanship, drawing, and business organization are helpful.

It is recognized that some applicants for the program may not meet all of the above requirements. In such cases, the school offering the technical training may find it necessary to provide sufficient prerequisites to bring the enrollees up to standards. *It is important for the school to maintain sufficiently high standards so that graduates will be able to perform satisfactorily on the job.*

Personal Requirements

The advisory panel for the preparation of this curriculum guide strongly recommended that students who wish to enroll undergo a complete physical examination. The reaction of individuals to dust from grain and feed operations and the physical requirements of some jobs in the industry are such that students should be aware of the problems before expending time and money to complete the training. The advisory panel especially recommended an eye examination, particularly for color blindness; judging the quality of grain requires normal vision.

Students entering this program should have acceptable attitudes toward work, including a sense of responsibility to the employer, a willingness to do a reasonable day's work, and the ability to get along with others.

Guidance and Counseling

Effective guidance and counseling are essential. It is important for the students to be aided in selecting educational and occupational objectives consistent with their interests and aptitudes. Whenever possible, institutions offering technical programs should consider the use of standardized or special tests to assist in student selection, placement, and guidance. A student should be advised to revise his educational objectives if he appears more suited to other pursuits, either by lack of interest or by lack of potential to make satisfactory progress in the program.

Placement

The graduates of the program should be assisted in finding suitable employment. Placement personnel must be aware of the needs of the industry and acquaint prospective employers with the qualifications of the graduates. The placement function is extremely valuable to the students, the institution, and the industry. The school also has a responsibility for the follow-up of employed graduates. The performance of these graduates indicates the effectiveness of the program. In addition the alumni can provide a helpful advisory service to the school.

Laboratory Facilities and Equipment

The laboratories suggested in this guide are planned for classes of 16 students and for semesters of 17 weeks, with 16 weeks of actual class and laboratory work.

Laboratories and equipment for teaching should meet high standards of quality since the objectives and strength of the program lie in providing valid laboratory experience along with adequate occupational experience and a sound basic understanding of principles and practices of the industry.

Adequately equipped laboratories with sufficient facilities for all students to perform the laboratory work are required for these courses. The training program should provide experiences in the wide variety of activities characteristic of the industry.

Variety and quality of equipment and facilities are more important than quantity. Laboratory equipment and facilities represent a major element of the program's cost; they are indispensable if training objectives are to be met.

In the selection of laboratory equipment, the need for each item should be established. Instructors must be aware of the limitations of the equipment in terms of teaching students to work in the environment they are likely to encounter in the industry. They need to know that the purpose of many of the laboratory experiences is to teach principles. Expensive apparatus may not always be required. In some cases, the simpler laboratory equipment may be more effective.

The possibility of renting laboratory equipment may be investigated by the local school or by the State vocational education office. The advisory panel assisting with the development of this guide indicated in a discussion that rental of equipment to be housed in the school laboratory would probably be impractical. It was suggested, however, that arrangements might be made to rent the facilities of a local farm supply center when it is not open for business.

Such an arrangement would require very careful supervision in terms of safety for students, plant, and equipment. A member of the staff of the farm supply center should be present whenever the class is using the center for training purposes.

The lists of equipment suggested in this guide (beginning on page 143) indicate a fairly extensive laboratory program. If an adequate occupational experience program is included, some of the more elaborate equipment might be omitted. Care must be exercised to make sure that adequate equipment and space are available for teaching.

The number of units purchased, the particular industry emphasis, and the ingenuity of the instructors will play a major part in governing the selection and cost of the laboratory equipment.

Throughout the program, emphasis should be placed on the basic principles by which the industry functions.

Textbooks, References, and Visual Aids

Textbooks, references, and visual aids for teaching any technology must constantly be reviewed and supplemented in light of (1) the rapid development of knowledge in the fields and (2) the results of research in methods of teaching.

New textbooks will reflect new methods of teaching scientific principles and applications as fast as current educational research becomes applicable. Extensive research in methods of teaching in the use of educational media for teaching will undoubtedly bring about changes in teaching materials and methods. It is therefore necessary for instructors to constantly review and evaluate new texts, references, and visual materials and to adopt those that represent improvement over those presently in use for the program.

From the reference books listed in the Bibliography and with the unit descriptions, suitable texts should be selected. For some courses, it will be necessary for the instructor to supplement a text with a variety of reference materials since there is no single source which adequately covers the necessary subject matter of the course. On the other hand, there undoubtedly are unlisted books that are excellent and that should be included for appropriate courses.

Before an instructor undertakes any of the courses in the curriculum, he should familiarize himself with the texts, references, and other instructional media listed here, plus any others he may find. He then will be able to select those most appropriate for the needs of his students and the program.

Visual aids and other instructional media such as tape recordings will also be of help in many teaching situations. Included in the guide are suggested filmstrips, slides, recordings, and educational motion pictures. Since new visual aids are constantly becoming available from many sources, it is suggested that instructors make careful selections from those listed in this guide as well as from new productions which are appropriate for the program.

Scientific and Technical Societies, Trade Associations, and Grain Exchanges

Scientific and technical societies, trade associations, and grain exchanges are an important source of instructional materials. Such societies provide in their publications and in their programmed meetings a continuing disclosure of new concepts, processes, techniques, and equipment. They are probably the greatest single means by which persons engaged in applying a particular body of knowledge can keep abreast of new developments.

Instructors in technical programs should be encouraged to become active members of scientific and technical societies, associations, and grain exchanges to help keep abreast of new developments and to foster acquaintance with persons most interested in the field.

Early in their training, students need to become aware of the literature and purposes of scientific and technical societies, trade associations, and exchanges related to the grain, feed, seed, and farm supply industry. The literature of these organizations should become an important part of the study materials throughout the program. A list of these organizations is included in Appendix I.[1] Instructors should review this list and secure as many publications as possible.

Library Content and Use

Rapid changes in technological science and practice make it imperative that students learn to use and retain an association with the library. The school should provide a library staffed by competent librarians and well stocked with current and pertinent books, pamphlets, bulletins, scientific and technical journals, basic references, visual and audio materials, and trade journals.

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[1] See also: U.S. Department of Health, Education, and Welfare, Office of Education. *Scientific and Technical Societies Pertinent to the Education of Technicians* (Technical Education Program Series No. 7, FS 5.280:*80037*) Washington, D.C. 20402: Superintendent of Documents, U.S. Government Printing Office, 1965.

In any evaluation of a technical education program, the qualifications of the librarian, the physical library facilities, the quality and quantity of content, and the organization of the library give tangible indication of the strength of the program.

Instruction in this program is library oriented. Students should learn the use of a library and form the habit of using it as a tool in the learning process. This helps to develop a professional attitude in the students and assists them in using libraries as a means of keeping abreast of developments in a rapidly changing technology.

Instructors must keep the students constantly aware of the extent to which the use of the library is a part of the curriculum. Teachers should also assist the students in planning their studies. Students should divide their time among their courses so that they can do justice to their total program rather than concentrating on one course while neglecting others. Assignments calling for the use of the library enables the students to understand the resources available in libraries and how they relate to their field of work. Open-book examinations provide excellent and objective experiences for the students in relation to the use of the library.

The library contains the books required as references, and every attempt should be made to insure extensive use of these facilities. It is suggested that the texts and references and at least some of the materials listed in the Bibliography and visual aids lists be used for starting the library. In addition, it is suggested that the library not only subscribe to a number of trade and scientific journals but also be placed on the mailing lists of appropriate U.S. Government bureaus and departments, agricultural experiment stations in land-grant colleges and universities, and appropriate industrial concerns related to the industry. These materials will be useful for students in many areas of work related to agriculture and the biological sciences.

Advisory Committees

For a technology program such as this, it is very important that a committee be appointed to *give advice* concerning the program. The committee will be made up of representatives of the industry and of related business and industry located in the vocational-technical district, area, or State for which trainees are to be provided.

The committee will be important to the success of the program. Members will be able to provide information regarding numbers of trainees needed, and specific abilities needed by the trainees to be of most help to employers; and they will be helpful in the placement of graduates. The committee will also aid in recruiting students for the program and in providing assistance and facilities for field trips, training stations for occupational experience, and in recommending facilities and equipment needed for laboratory activities. In addition, the advisory committee is an important asset in improving the status of occupations in the industry. The advisory committee will also assist in the orientation of students in terms of the needs of the industry.

Regardless of the size or nature of the area the committee is to represent, members should be appointed by the responsible educational authority and approved by the governing board. The duties and responsibilities of the advisory committee should be clearly understood so that conflicts will be avoided and maximum service rendered.

THE CURRICULUM

A 2-year curriculum must concentrate on primary needs if it is to prepare individuals for responsible technical positions in modern industry. It must be realistic and pragmatic in its approach. *The curriculum suggested in this bulletin has been designed to provide maximum technical instruction in the scheduled time.*

To those who are not familiar with this type of educational service (or with the interests and goals of the students who elect it), the technical program often appears rigid and restrictive. While modifications may be necessary in individual institutions, the basic structure and content of this curriculum should be maintained.

This curriculum includes (1) basic science courses; (2) specialized technical courses for the grain, feed, seed, and farm supply industry; (3) communications courses; and (4) occupational experiences. The basic science courses provide applications of scientific principles and, therefore, must be carefully coordinated with the specialized technical courses at all stages of the program. The sequence of courses is specially arranged to contribute uniquely toward the final objective of graduating a competent technician. Each course must be directly integrated into the curriculum. If close correlation of courses is not maintained, the curriculum will not provide the depth of understanding required by modern grain, feed, seed, and farm supply technicians.

The following chart suggests a program of post-high school training for the grain, feed, seed, and farm supply industry. Courses are designed on a semester basis, with each semester assumed to be 17 weeks, including 1 week for examinations and nonclass activities. Four semesters are planned, which (with a satisfactory program of occupational experience) will cover a period of 2 years. Adaptations can readily be made to a quarter or trimester program.

It will be advantageous to check with the advisory committee and to schedule the semesters of class work in such a way as to provide the most desirable occupational experience possible. For example, if students need occupational experience in September, October, and November, one semester of class work may be offered during the summer months.

Note also that the chart suggests the time to be spent for class, laboratory, and outside study for each subject. It is assumed that class periods may be conducted as discussions at appropriate times. Laboratory periods for such classes as *Grain Grading* will follow the traditional pattern of practice, study, and evaluation. Other classes may profitably use a laboratory period; for example, classes studying prices might use laboratory periods to prepare charts and graphs to illustrate the analyses they have made of prices. This type of laboratory is highly desirable as a means of helping students learn to apply their findings in practical situations. It is becoming increasingly popular in courses dealing with economic and marketing data. Laboratory periods may also be used for field trips and for other class activities which require more time than the traditional periods.

Sections of the United States vary in their major agricultural products. These differences have prompted the inclusion of optional courses. Where appropriate, these may be substituted for courses or parts of courses to provide the proper emphasis for the region being served by a specific program.

The relative importance of individual courses will depend on the main agricultural products of the territory served by the school. School administrators and instructors should use the advisory committee to help them choose courses and units within some of the courses that should be emphasized in a local program.

The courses *Applied Animal Husbandry I* and *Applied Animal Husbandry II* are designed to provide instruction in as many or as few of the livestock enterprises found in the area in which graduates are likely to find employment. In some parts of the United States, instruction might concentrate on dairy and poultry enterprises, while in other sections emphasis might be placed on the beef and swine interests.

Note, however, that the basic science courses are essential and should be retained regardless of other substitutions.

Grain, Feed, Seed, and Farm Supply Curriculum Outline

	Hours per Week			
	Class	*Laboratory*	*Outside Study*	*Total*
First Semester				
Crop Production	2	6	4	12
Soil Science I: Fertility	2	6	4	12
Applied Animal Biochemistry	1	6	2	9
Structure of the Grain, Feed, Seed, and Farm Supply Industry	3	0	6	9
Communications I: Written, Graphic	3	2	6	11
Total Hours	11	20	22	53
Second Semester				
Grain Grading	1	6	2	9
Soil Science II: Fertilizers	2	6	4	12
Applied Animal Nutrition	3	4	6	13
Agricultural Economics and Marketing	3	0	6	9
Communications II: Oral, Illustrated	3	2	6	11
Total Hours	12	18	24	54
Third Semester				
Retail Farm Supply Merchandising	3	4	6	13
Feeds, Ingredients, Additives, and Food and Drug Regulations	3	4	6	13
Operations I: Purchasing, Financial Control	3	2	6	11
Applied Animal Husbandry I: Beef, Sheep, Dairy	2	4	4	10
Seminar: Personal Relationships, Personal Finances, and Management	2	2	4	8
Total Hours	13	16	26	55
Fourth Semester				
Grain Handling, Warehousing, and Merchandising	3	4	6	13
Operations II: Functions of Management, Financing	3	2	6	11
Agricultural Chemicals	3	2	6	11
Salesmanship	1	6	2	9
Physical Facilities and Care of Equipment	1	8	2	11
Total Hours	11	22	22	55
Optional courses which may be substituted by the school administrator where appropriate:				
Seed Production, Preparation, and Analysis	1	6	2	9
Business Law	3	0	6	9
Applied Animal Husbandry II: Swine, Poultry, Horses	2	4	4	10

Brief Description of Courses

First Semester

CROP PRODUCTION

This course is designed to develop the understandings and abilities in crop production needed by employees of the grain, feed, seed, and farm supply business as they select, recommend, sell, and service materials sold by their firms to customers in the area. Included are units dealing with (1) food production, (2) classification of crops, (3) factors determining the choice of the species and the variety, (4) crop management practices, (5) harvesting grain and feed crops, (6) certified seed, and (7) plant growth factors.

Laboratory projects deal with identification of various kinds of crops and their seeds, identification of weeds affecting crops, with an introduction to herbicides used in their control, the calibration of machinery used in crop production, and an analysis of field productivity characteristics.

SOIL SCIENCE I: FERTILITY

This basic soil science course is designed to provide the background necessary for the student to work in the fertilizer department of the farm supply center. The course provides knowledge of soil classification and crop adaptation; productivity characteristics of soil; the relation of environmental factors such as drainage, temperature, and the like to production; plant nutrients; relation of fertility to pH level; soil tests and their interpretation; and the importance of micro-nutrients.

APPLIED ANIMAL BIOCHEMISTRY

This basic science course familiarizes the student with the application of biochemistry to the processes of digestion and the supplying of energy to livestock and poultry. An understanding of essential nutrients in animal feeds and the ability to interpret feed formulas will be developed.

STRUCTURE OF THE GRAIN, FEED, SEED, AND FARM SUPPLY INDUSTRY

This course gives the student a broad overview of the total industry, including grain, feed, seed, fertilizer, and agricultural chemicals. The student will become acquainted with the function of the farm supply center in the total industry. The types of business organizations and the place of the terminal elevator, the processor, and the exporter are included. Information on transportation as it affects the industry is also presented. An attempt is made throughout to develop an understanding of the how, what, and why of the development of the industry in terms of its present pattern.

COMMUNICATIONS I: WRITTEN, GRAPHIC

This course deals primarily with the preparation of written materials. Development of the ability to write letters, scripts, promotional materials, and summaries of demonstrations and instructions as well as practice in the use of graphic materials are included. The student is also taught to prepare personal records relating to employment and personnel records needed by the industry.

Second Semester

GRAIN GRADING

This course is designed to prepare the student to grade grain according to the United States Grain Standards Act as administered by the United States Department of Agriculture. The course developes (1) an understanding of the purpose of grain grading, (2) an understanding of the practices of the grain trade regarding grades, (3) an understanding of the Federal regulations regarding standards for grain for human consumption and for use as feed, and (4) the technical ability to grade grain according to the standards promulgated by the Secretary of Agriculture. Food and drug regulations regarding residues of agricultural chemicals are included. The student completing this course should be able to sample and grade grain with a high degree of accuracy.

SOIL SCIENCE II: FERTILIZERS

This course includes material needed by the employee who is responsible for recommending, formulating, selling, and applying fertilizer for customers as well as material for the employee who follows up on the customers to check on the effectiveness of the fertilizer. Included in the course are units on (1) fertilizer requirements, (2) soil moisture and plant growth, (3) fertilizers of the soil, (4) soil microorganisms, (5) sources of raw materials, (6) formulation of fertilizers, (7) recommending a fertilizer, (8) method of application, (9) loss of fertilizer, (10) storage of fertilizer, (11) lawn and garden fertilizer, and (12) use of micro-nutrients.

APPLIED ANIMAL NUTRITION

This basic applied science course is designed to acquaint the student with the classification of forages and grains as feeds, the nutrients needed to provide for growth in livestock and poultry, the factors related to feed efficiency, and the techniques of formulating feeds adjusted to the production needs of the customer. This course provides basic information needed by processors, salesmen, and servicemen in meeting the requirements of livestock and poultry producers for suitable feeds.

AGRICULTURAL ECONOMICS AND MARKETING

The course is designed to help the student understand the application of economic principles to agricultural distribution. Emphasis is placed on laws of supply and demand, price determinants, and the role of the middleman in the market. Elements of production and an analysis of cost factors affecting production and distribution are also included.

The effect of government policies on the market and their influence in causing changes in market procedures, the need for grades and grading, and an analysis of grades of agricultural commodities are included.

COMMUNICATIONS II: ORAL, ILLUSTRATED

The second semester of the communications sequence deals with oral communication and the development and use of visual materials to support the oral presentation. Included is work in oral communication in small groups, in committees, and with large groups. Emphasis is placed on the importance and use of communications in business. Laboratory periods are devoted to the preparation and use of visual materials in oral communication. These will include the preparation of drawings, sketches, transparencies, models, specimens, and the like.

Third Semester

RETAIL FARM SUPPLY MERCHANDISING

The course deals with merchandising at the farm supply center. It is designed to develop a maximum of understanding and ability to (1) make a market survey, (2) build an advertising calendar, (3) prepare an advertising budget, (4) write advertisements, (5) construct displays for use at the farm supply center or at community events such as county fairs, and (6) plan and use promotion days.

FEEDS, INGREDIENTS, ADDITIVES, AND FOOD AND DRUG REGULATIONS

This course deals with the technical work of the feed mill-farm supply center where formulating and mixing feed rations for customers are practiced. Selection of ingredients to provide specified amounts of nutrients, use of feed additives such as minerals and antibiotics, and types of feeds to recommend for different classes of animals and for different purposes are important parts of the course. Appropriate food and drug regulations of the State and Federal governments are also studied. Laboratory periods are planned to provide experience in formulating feeds for various purposes and for appropriate classes of livestock. Alternative ingredients are considered in formulating feeds.

OPERATIONS I: PURCHASING, FINANCIAL CONTROL

This course is part of a sequence covering two semesters. It deals with the methods of operation of the elevator and farm supply center. The course covers methods of (1) purchasing, margins, markup, and pricing; (2) using the accounting system; (3) budgeting; (4) inventory control; and (5) credit control. Class sessions are designed to help the student understand the principles involved in the aspects of business operation included in the course. Laboratory sessions give the student an opportunity to study and apply principles to actual methods and practices of the business.

APPLIED ANIMAL HUSBANDRY I: BEEF, SHEEP, DAIRY

This course deals with the application of recommended animal husbandry management techniques essential for success in the beef, sheep, and dairy enterprises. It is important for those employed in the grain, feed, seed, and farm supply industry to know their customers' practices. In some cases, employees will be able to recommend changes in management that will improve profits for the producer and the firm. In other cases, problems may be referred to the veterinarian, specialists employed by the feed manufacturer who may be available through the dealer to serve customers, or the Federal Extension Service.

The course is organized in the following units dealing specifically with the beef, sheep, and dairy enterprizes: (1) management for success; (2) breeds and breeding; (3) housing beef, sheep, and dairy; (4) disease and parasite control; (5) avoiding accidents; (6) feeding; and (7) systems of management.

SEMINAR: PERSONAL RELATIONSHIPS, PERSONAL FINANCES, AND MANAGEMENT

This seminar is designed to assist the student in applying for a job and in managing his affairs as an employee. Included is training in basic principles of economics, personal finances, savings, and investment. Preparation of applications for jobs, demonstrations and practice for interviews, and study of job descriptions are also essential parts of the seminar.

Fourth Semester

GRAIN HANDLING, WAREHOUSING, AND MERCHANDISING

The course is designed to acquaint the student with the steps in movement of grain from the farm through the country elevator and in the steps of merchandising grain by the country elevator. The student should develop an understanding and appreciation of the functions performed at each step in the movement of the grain, including prudent warehousing. In addition, he should become aware of the factors influencing the market under a free enterprise system. The course includes nineteen divisions, with suggested laboratory projects related to the respective units.

OPERATIONS II: FUNCTIONS OF MANAGEMENT, FINANCING

This is the second semester of a two-semester sequence dealing with problems of operation of the elevator or farm supply center business. It includes (1) types of business organization and sources of capital, (2) functions of management, (3) depreciation of buildings and equipment, and (4) insurance. Class sessions are designed to provide the student with an understanding of the principles involved in the aspects of business operation included in this part of the two-semester sequence. Laboratory sessions are designed to give him an opportunity to study and apply principles to actual practice and methods in the business.

AGRICULTURAL CHEMICALS

The course deals with the use of herbicides, insecticides, fungicides, and nematocides; and external and internal parasites of livestock, poultry, and pets. Types of materials, the methods of use, and safety measures to be followed are emphasized throughout the course. Much stress is placed on the student developing ability to interpret and to explain to customers the directions for use and the cautions to be observed with the products.

SALESMANSHIP

This course is designed to provide the student a maximum of opportunity to apply the principles of salesmanship. Role playing is suggested as a major method of providing the practice. Included in the course are units on (1) the purpose of selling; (2) the salesman; (3) locating and qualifying prospects; (4) customers, their needs and wants; (5) steps in making a sale; and (6) sales promotion and advertising helps for the salesman.

PHYSICAL FACILITIES AND CARE OF EQUIPMENT

The course will acquaint the student with the facilities and equipment commonly found in the grain, feed, seed, and farm supply centers typical of the area. Emphasis is placed on the arrangement of facilities for efficient and safe operation and on the adjustment, maintenance, and operation of equipment. Laboratory activities include planning and drawing layouts of buildings on the site, planning flow of material, practicing the adjustment and maintenance of various kinds of equipment, and keeping adequate records on the operation and performance of each machine.

Optional Courses

SEED PRODUCTION, PREPARATION, AND ANALYSIS

This course provides training in the techniques of selection, storage, and conditioning of seeds. Duplication of subject matter with courses dealing with grain grading is avoided by placing emphasis in this course on special techniques necessary for the seed trade. The student will have an opportunity to practice the cleaning, sampling, labeling, treating, and testing for germination of forage and grain seeds.

BUSINESS LAW

This course is designed to develop an understanding of principles of business law as they apply to the grain, feed, seed, and farm supply business at country points. Included are lecture-discussion periods in which the student studies, identifies, analyzes, and prepares instruments commonly used in the business. Units covered include (1) the importance of an understanding of business law, (2) contracts, (3) negotiable instruments, (4) public liability, (5) product liability, (6) employee relations, and (7) Federal and State laws and regulations regarding the industry.

APPLIED ANIMAL HUSBANDRY II: SWINE, POULTRY, HORSES

It is important that technicians in the grain, feed, seed, and farm supply industry be familiar with the application of animal husbandry and poultry management techniques essential for success with swine, poultry, or horse enterprises so that they may be able to recommend changes in management that will improve customers' profits. This course is organized in the following units: (1) successful management of swine, poultry, and horse enterprises, (2) breeds and breeding, (3) housing, (4) disease and parasite control, (5) avoiding accidents, (6) feeding, and (7) systems of management.

Occupational Experience Training

Occupational experience is provided by the placement of a student in a job with a carefully selected employer member of the grain, feed, seed, and farm supply industry. The primary purpose of cooperative occupational experience is the development of competence in the student. In many instances, occupational experience will be a prerequisite for employment. Experience in some phases of the grain, feed, seed, and farm supply industry is likely to be preferred by employers. In any case, they will be interested in evidence of satisfactory attitudes on the part of prospective employees.

When occupational experience programs are arranged, the coordinator from the school meets with each employer to plan an experience program which will supplement the training the students receive in the class and laboratory. This permits students to gain experience with machinery and equipment not available at the school and to become familiar with some aspects of the business operation in which they need additional experience.

The work experience aspect of the training program should be as much a part of the curriculum as the class and laboratory work. The plans should be carefully worked out with the advisory committee, the instructional staff, and the coordinators. Included in the plans should be guides for the occupational experience program for students and statements regarding the responsibilities of the student, the employer, and the coordinator. It is suggested that appropriate credit be given for occupational experience, the same as for other aspects of the training program.

Suggestions for organizing the occupational experience program may be secured from vocational education directors in State departments of education. Sample forms are included in Appendix III.

Essentially, the occupational experience plan utilizes the work situation as a "school laboratory"; the skills are developed under supervision, while the related instruction is provided in the school. The cooperative plan involves:

1. Related instruction in school. In some situations, this may be given on the same day that the occupational experience is obtained. For example, classes may begin at 2 p.m., leaving

the student available for an occupational experience program in the morning. In the program described in this guide, however, the school instruction and the cooperative experience would be given in alternate semesters.

2. Selected training stations. The coordinator from the school must make sure that the training station will provide an adequate, up-to-date situation for the training.
3. Planned program. A planned program of instruction is essential. If the suggested courses in this guide are followed, the occupational experience program would be developed to supplement the program being provided in the classroom and laboratory. The plan should indicate a step-by-step outline of what is to be learned and whether it is to be learned in the classroom or at the training station. The plan should be developed jointly by the instructor-coordinator and the training station sponsor.
4. On-the-job supervision. This requires the assignment by the training station sponsor of an experienced employee, supervisor, or manager to be directly responsible for the occupational experience of the student.
5. Adequate coordination time. Adequate time must be allocated for the coordinator to work with the training station sponsor and the student to make sure that the occupational experience program is maintained at a high level of quality and efficiency.
6. School policy. The school must adopt and maintain a well-defined policy regarding the occupational experience program. This policy establishes minimum standards for training stations, responsibilities of the instructor-coordinator, and standards for the progress of students.
7. Organized program records. Well-organized program records are necessary to evaluate the program. Records should include the history of the training program, reports of progress, reports of the instructor-coordinator and of the training station sponsor. Follow-up records of graduates should be kept current.
8. Advisory council. An advisory council made up of representatives of the industry, together with school administrators and others, is essential for the success of the occupational experience program. The advisory council will be able to recommend times of the year when students could best be placed in a business for experience. It can do much to inform the community about the program and to help set adequate standards for its operation.
9. Employer-student employee agreements. In all cases, the students should be treated as beginning employees. The agreement with the employer should provide for wages and other benefits commensurate with those of any other beginning employee with equal experience and ability.

To assure an understanding of the occupational experience program, agreements involving the program should be in writing and signed by the employer, the student, and the coordinator representing the school. In some programs, parents of the students are also asked to approve the agreement. This may be desirable to help bring about complete understanding regarding the program. The following kinds of items may be incorporated into the agreements. Additional suggested materials on occupational experience are in the appendix.

I. Goal

To give the student occupational experience which will enable him to acquire skills and gain practical knowledge necessary in the grain, feed, seed, and farm supply industry.

II. General

The on-the-job training period for the grain, feed, seed, and farm supply industry course is from .... to ....

The training program is arranged on an individual basis between the student, the manager, and the course coordinator.

On-the-job training agreements may be terminated by either the employer, the student, or the coordinator for sufficient reason. It is understood that a minimum of 2-weeks' notice will be given to all parties and that all measures will be taken to assure fair treatment to all concerned.

While in occupational training, the student is registered at the school and is subject to the jurisdiction and discipline of the school. The student is required to submit a monthly report due on the fifth of each month following the month reported.

III. Student Responsibilities

The student agrees to work with his selected organization for the period of occupational training unless terminated according to Paragraph 3 of "General."

The student agrees to conform to the normal work hours of the organization. (It may be necessary to work longer hours during a busy season.)

The student is expected to:

a. Perform in deed and word to the employer's best interest.

b. Perform all duties requested by the employer cheerfully and to the best of his ability.

c. Refrain from discussing his employer or his business without permission and certainly *never* to his detriment.

d. Report to work *on time.*

e. Be neat in appearance and properly dressed for work.

f. Be courteous at all times.

g. Be a credit to himself, his employer, and the school.

h. Complete all reports and forward them to the coordinator by the fifth of each month.

i. Collect information necessary for a detailed final report which will evaluate his placement activities.

The student will advise the coordinator of his home address and inform him of any change.

The student will request permission from the *employer and coordinator* before taking time off during the occupational training period.

IV. Employer Responsibilities

The employer agrees to employ the student for the occupational training period unless terminated as by Paragraph 3 of "General."

The employer agrees to pay the student the starting wages agreed upon. Increases in pay may be given as the employer sees fit.

The employer should give the student the opportunity to work on different jobs during the training period in order that he may acquire skills and become familiar with the various phases of business.

The employer is expected to counsel with the student at various times during the training period so that the student will have an opportunity to question the employer relative to various operations.

The employer agrees to notify the coordinator regarding any problems that may develop relative to the student's conduct or period of employment.

The employer agrees to submit an evaluation of the trainee at the end of 3 weeks, 3 months, and at the end of the training.

V. Coordinator's Responsibilities

The coordinator is expected to be present when the placement training program is being developed.

The coordinator will counsel with the student and the employer once each 2 weeks to determine the student's progress and to advise relative to his program of study.

The coordinator will strive to promote harmony and cooperation between the employer, the student, and the school. His services are available in any way that may be beneficial to the training program.

Curriculum Content and Relationships

Sequence in Terms of Understanding

It is important to recognize the need for a sound sequence of courses for the training of technicians. The courses listed in this guide are designed to be offered in the sequence shown in the Grain, Feed, Seed, and Farm Supply Curriculum outline, to aid the student's understanding of the subject matter. It is desirable to precede the *Applied Animal Husbandry I* and *Applied Animal Husbandry II* courses with *Applied Animal Biochemistry; Applied Animal Nutrition. Feeds, Ingredients, Additives, and Food and Drug Regulations* can be taught concurrently with *Applied Animal Husbandry I.* School administrators and instructors should be cautious, in changing course sequences when modification of the program is being considered.

Sequence in Terms of Preparation for Occupational Experience

A second consideration for sequential position of courses is that of preparation for occupational experience. The order of courses suggested here should provide the student with an understanding and appreciation of the total industry and its importance in the economy. At the same time, the suggested sequence will provide training in some of the fundamental technical aspects of the business so that the student will be able to function satisfactorily when he is placed for occupational experience after the first or second semester of his program.

Understanding by the student of the contribution occupational experience can make to his training may also be developed through the suggested sequence of courses. Regardless of where periods of occupational experience are placed, the student will discover after the first semester some aspects of the industry in which he needs experience that cannot be adequately provided in the school laboratories.

Preparation for More Technical Courses

A careful examination of the suggested course sequence, together with the suggested course outlines and laboratory projects, will indicate the importance of planning a sequence of courses from the more basic foundation courses to the more technical courses. Such courses as *Soil Science I, Soil Science II, Crop Production, Applied Animal Biochemistry, Communications I, Communications II,* and others in the first and second semesters should provide a sound basis for the more technical courses, *Operations I; Operations II; Grain Handling, Warehousing, and Merchandising; Feeds, Ingredients, Additives, and Food and Drug Regulations;* and others appearing in later semesters.

Concepts of Employer-Employee Relationships

The communications courses, as well as *Structure of the Grain, Feed, Seed, and Farm Supply Industry* and others, will provide a sound basis for desirable employer-employee relationships during the occupational experience and on the job following graduation. The suggested laboratory projects are designed to develop understanding of desirable relationships and responsibilities, as well as the skill and ability necessary in the subject area.

Emphasis on Safety

Principles of safety should be taught as an integral part of each course dealing with the operation of the plant or equipment. The hazards in the grain, feed, seed, and farm supply industry are somewhat unique, particularly in terms of explosions, fire, and the use of chemicals. The nature of the operations, in the grain and feed business particularly, involves dust which may be very explosive. It is important to practice safety in regard to personnel and equipment at all times. This involves use of proper equipment and protective devices for cleaning and fumigating bins, operating machinery, and processing materials.

Emphasis on safety is particularly appropriate in the courses *Physical Facilities and Care of Equipment* and *Agricultural Chemicals.* Safety also must be stressed in such courses as *Seed Production, Preparation, and Analysis; Feeds, Ingredients, Additives, and Food and Drug Regulations;* and *Grain Handling, Warehousing, and Merchandising.*

When students visit industrial or business firms on field trips or for class instruction, it is important that the school authorities make sure that there is adequate insurance against accidents and injuries to students or damage to equipment and facilities of the firm.

Students and instructors also need to be made aware of the responsibility of the industry concerning pollution of air and/or water such as may be caused by dust and smoke from feed-processing plants.

Planning the Schedule

The courses are designed for 17-week semesters, with 16 weeks of actual class attendance. A typical program for the first semester would include 11 hours of class work, 20 hours of laboratory work, and 22 hours of outside work, or a total of 53 hours a week. Other semesters include 54, 55, and 55 hours of work.

In the limited class time the student will not be able to master all the necessary material. Therefore, the 2 hours of outside study have been scheduled for each hour of class. The instructors should make specific assignments for outside study to help the student master the essential material.

Suggested Continuing Study

A 2-year curriculum must concentrate on the basic knowledge and skill necessary for employment and cannot cover in depth all the subjects pertinent to the technology or even touch upon some important related subjects. The graduate can keep abreast of some technological developments by reading current literature, but here he can only build on the foundation provided by his curriculum. Formal continuation or supplementary courses provide the most efficient and practical means for the graduate technician to add important related areas of knowledge and skill to his initial education. They have the advantage of systematic organization of subject matter, disciplined and competent teaching, class discussion, and they may be scheduled for evening or Saturday hours outside the working day.

Some suggested continuation-study programs for graduates of this curriculum include the following:

Chemistry and biochemistry
Agricultural economics
Business management and supervision
Plant nutrition
Grain merchandising
Entomology
Animal nutrition
Agricultural marketing
Soil chemistry
Soil physics
Transportation
Specialized courses in fertilizer

COURSE OUTLINES

The courses which follow provide a practical and attainable coverage of the field and have been reviewed by experienced instructors in successful technician training programs and by experts representing employers of skilled technicians in grain, feed, seed, and farm supply businesses.

It is expected that these courses be modified in some measure to fill the needs defined by local advisory committees and to take advantage of special interests and capabilities of the teaching staff in any particular institution, but the implied level, quality, and completeness of the program should not be compromised.

At the end of the description of each course is a list of text and reference materials. Each should be analyzed for its content and pertinency, and new and more suitable ones should be substituted if they are available. The information needed to cover a particular course in technician educating curriculums, particularly the technical specialty courses, is almost never available in one textbook; hence, the multiple listing of references. They usually should be considerably augmented by current materials from manufacturers, trade journals, technical societies, and suppliers of apparatus and services in the special field of applied science being studied.

Suggested visual aids are listed for many courses. Each should be used when pertinent and when its use will teach more efficiently than any other method. *Excessive showing of films at the expense of well-prepared lectures and demonstrations is to be avoided.* The suggested outside-study periods may well be used instead of class lecture time for the showing of some films. All visual aids should be examined by the instructor before they are shown.

It is expected that the experienced instructor will make liberal use of charts, slides, models, samples, and specimens which illustrate special technical aspects of the subject; these should be up-dated regularly.

Laboratory time listed for each course means total hours devoted to the subject per week; this time is to be used in effective increments and not necessarily in a single session. Instructions given under the heading "Laboratory Projects" are meant for the students, unless otherwise specified.

Applied Animal Biochemistry

HOURS REQUIRED

Class, 1; Laboratory, 6.

COURSE DESCRIPTION

The course is designed to give students sufficient background in chemistry and biochemistry to enable them to understand the principles of animal nutrition and the feeding of suitable rations for farm animals and poultry. Since many of the students who enroll in the grain, feed, seed, and farm supply program will have relatively little background in chemistry, it will be desirable to begin this course with some of the elementary aspects of general chemistry and to move rather quickly into the phases of biochemistry dealing with digestion and nutrition of farm animals and poultry.

The instructor keeps in mind that the objective of this course is to provide students with a basis for developing understanding and skill necessary to balance rations. They must recognize the importance of suitable feeds for the digestive systems of animals, and they must understand and appreciate the importance of the essential elements, vitamins, minerals, and hormones in the efficient production of livestock and livestock products.

The laboratory work which is suggested for this program is designed to help meet the above objectives. The chemical tests for determining nutrients in feedstuffs should make students aware of the sources of data they will use, but they need not become expert in performing the tests.

Due to the high cost of the equipment needed for laboratory tests, it would be desirable to organize the class into groups to rotate through a series of laboratory projects rather than to have each student perform the same activity at the same time. An alternative may be for groups of students to perform specific projects as a demonstration before the class.

In both the class sessions and in the laboratory sessions, the instructor should continually indicate to students the practical application of the subject matter to the feeding and nutrition of livestock and poultry. Instruction must also emphasize the responsibility of the farm supply center staff to be well-informed regarding feeding problems.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Introduction, Review, and Background in Chemistry	2	6
II. Chemistry of Digestion	2	12
III. Determining Nutrients in Feedstuffs	2	32
IV. Digestibility of Feedstuffs	3	16
V. Storing and Releasing Energy	3	10
VI. Role of Essential Elements	4	20
Total hours	16	96

Division I. Introduction, Review, and Background in Chemistry

A. Unit of Instruction
   1. Nature of matter
   2. Compounds, elements, and mixtures
   3. Atoms, atomic weights, molecular weights
   4. Oxygen, hydrogen, solutions
   5. Electron theory, atomic energy
   6. The periodic table, formation of compounds from elements
   7. Chemical equations, acids, bases, salts
   8. Ionization, conductors and non-conductors of electricity
   9. Standard solutions, titration
   10. Nitrogen, ammonia
   11. Carbon, oxides, and acids of carbon

B. Laboratory Projects

   The teacher reviews simple laboratory projects from general chemistry to help students recall fundamentals such as:
   1. Metric system of weights and measures
   2. Nature of matter
   3. Chemical equations
   4. Acids, bases, salts
   5. Basic compounds of carbon such as carbon dioxide, sugar, starches, alcohols

Division II. Chemistry of Digestion

A. Unit of Instruction
  1. Digestion of starches and sugars
    a. Release of energy
    b. By-products
  2. Digestion of fats
    a. Release of energy
    b. By-products
  3. Digestion of proteins
    a. Function of protein in animal nutrition
    b. By-products of protein digestion

B. Laboratory Projects
  1. Secure some small very young animals such as rabbits or white rats. Place them in individual cages and feed them complete rations. Record the weight of each animal daily, and also record the weight of feed each has eaten (amount offered minus amount left uneaten). Compute the amount of feed required per pound of gain. Compare the feed efficiency with that indicated in the literature for meat-producing animals.
  2. Prepare a chart tracing the digestion of starches and sugars through the digestive tract of an animal or bird. Show the digestive juices that act on the material, the products resulting from each, the reaction (acid or base), and the point in the digestive system where this digestion takes place. Indicate the point at which the nutrients are taken into the animal's body and where they are assimilated.
  3. Repeat for fats.
  4. Repeat for proteins.
  5. For each of the above, indicate the use to which these products may be put after they have been assimilated into the animal's body.
  6. Obtain from a slaughter house the digestive tracts of ruminants, poultry, and swine. Trace the passage of feed through each digestive tract. Sketch each tract and explain why ruminants are able to use more roughage and fiber than swine and poultry.

Division III. Determining Nutrients in Feedstuffs

A. Unit of Instruction
  1. Crude protein determination
    a. Protein in feedstuffs
    b. Protein equivalent in urea
  2. Carbohydrate determination
  3. Fat determination
  4. Mineral determination
  5. Interpretation of the feed tag information to the customer

B. Laboratory Projects
  1. Obtain a sample of feed. Analyze the sample in the laboratory for fats, nitrogen, N-free extract, fiber, and ash. Compare the results with the average of similar tests reported in the text and reference books. Convert the nitrogen in the feed sample to protein. How would this feed be labeled in terms of nutrients? Repeat for common grains and forages of the area and for by-product feeds, as time will permit.
  2. Repeat the preceding tests after different students have been assigned different qualities of grain and forage so that comparisons may be made of the nutrients and fiber in each sample.
  3. Collect tags or labels from a number of prepared feeds for livestock or poultry. Sort out the tags stating, " . . . per cent of protein from non-protein sources." Compute the amount per ton of urea in these feeds.
  4. Write a report one would use as an employee of a farm supply center to explain the meaning of the items on the feed tag at a meeting of livestock feeders. Include in the report an explanation of the feeds to be fed with the urea to assure efficient use of the urea by the animal.
  5. Select a grain or feed common in the area and run a protein test with the Udy protein analyzer. Compare the results with those obtained by others in the class for the same kind of material. Also compare the various kinds of material tested.
  6. Repeat the above tests using grains which were:
    a. Planted at different times, such as early- and late-planted barley

  - b. Harvested at different stages of maturity
  - c. Fertilized with different amounts of plant nutrients
  - d. Grown from different varieties

7. Secure a number of baby chicks (or white rats). Divide them in two groups. Select a ration deficient in Vitamin D. Feed this ration to one group and the same ration supplemented with Vitamin D to the second group. Keep a record of the condition, gain in weight, feathering of chicks or hair coat of rats, and feed efficiency for a period of six weeks. Prepare a written report as one would if he were an employee reporting on a demonstration of feeds he had for sale. Ilustrate the paper with photographs, if possible.

Division IV. Digestibility of Feedstuffs

A. Unit of Instruction
   1. Methods of determination
   2. Factors determining digestibility
   3. Significance of digestibility determination

B. Laboratory Projects
   1. Take a field trip to an experiment station or farm to observe experimental work being conducted on the digestibility of feeds. What controls are required to get accurate results with this kind of research?

      (*Note:* If laboratories conducting this type of research are not available, students may be assigned to study results of such research and to prepare a report showing digestibility of feeds commonly found in the area. The report should also indicate how all of the intake of an animal is accounted for and how the output of the animal is checked.)
   2. Select a by-product material that is not normally a satisfactory feed for livestock or poultry. Prepare a report to describe how the product may be treated chemically and made more digestible, thereby becoming a satisfactory feed ingredient.

Division V. Storing and Releasing Energy

A. Unit of Instruction
   1. Building cells (growth and replacement)
   2. Storing energy in plants and animals
      - a. Endosperm, roots, tubers
      - b. Fats in animals
   3. Release of energy by cells
      - a. Oxidation
      - b. Waste products

B. Laboratory Projects
   1. Use a table of data and record the energy values for the major grains and forages of the crops grown in the area. Prepare a chart showing the transformation of energy to the plant tissues. What is the variation of the energy value per pound of grain or forage? If one wanted to furnish more energy to an animal while adding a minimum of bulk, what feeds would he choose?
   2. Make a diagram showing how the energy of a feed crop might be released in the air, or released when fed to an animal. The diagram may be made as part of a carbon- or nitrogen-cycle chart, as a chemical equation, or by other means. What conditions must be present for the release of the energy when energy is released in the air, or when energy is released in the animal?
   3. Select one kind of farm animal or poultry. Prepare a talk which will describe how the animal gets and stores energy and also will show how the energy is released by the animal. Explain what the released energy is used for. Draw conclusions as to the environmental factors a livestock or poultry producer must consider to have an efficient enterprise.

      What losses of energy occur in the process of feeding grain to meat-producing animals or birds which are used for human consumption as compared with the human consumption of the grain itself?

Division VI. The Role of Essential Elements

A. Unit of Instruction

   Analyze the function, source, importance, and method of administering each of the following essential elements to livestock and poultry:
   1. Calcium
   2. Carbon
   3. Chlorine
   4. Cobalt
   5. Copper
   6. Fluorine
   7. Hydrogen
   8. Iodine
   9. Iron

10. Magnesium
11. Manganese
12. Nitrogen
13. Oxygen
14. Phosphorus
15. Potassium
16. Sodium
17. Sulphur
18. Zinc

B. Laboratory Projects

1. Check with a local veterinarian to find animals or birds suffering from deficiency symptoms of one of the essential elements in the ration. Arrange to observe these animals over a period of time while they are being treated, or arrange to treat them; report the effects of the treatment in a written report. If possible, take before and after photographs for use in the report or for use in making a bulletin board display of the project.
2. Make a list of the "essential elements" which are necessary for growth and production in animals or poultry. Indicate the function of each in the nutrition of the animal or bird, and suggest the source of the element for each class of livestock and poultry.
3. Take a field trip to a beef feedlot or to a broiler plant to observe the effect of using hormones on the production of the livestock or poultry. If possible, observe the difference in performance of treated and untreated animals and birds. Prepare a report for the manager of a feed department in a farm supply center on the use of hormones for meat animals and birds.

TEXTS AND REFERENCES

Albanese, *Newer Methods of Nutritional Biochemistry, With Applications and Interpretations.*

Benne, "Agriculture from the Chemical Viewpoint," *Better Crops with Plant Food.*

———, "Chemistry in the Cornfield," *Better Crops with Plant Food.*

———, "The Factories that Feed Us," *Better Crops with Plant Food.*

Comber and others, *An Introduction to Agricultural Chemistry.*

Conn and Stumpf, *Outlines of Biochemistry.*

Farm Chemicals Handbook.

Feed Additive Compendium.

Graham and Cragg, *The Essentials of Chemistry.*

Johnston, *Laboratory Manual for Biochemistry.*

Mallette, Althouse, and Clagett, *Bio-Chemistry of Plants and Animals.*

Metz, *The Chemistry and Technology of Cereals as Foods and Feeds.*

Oppe, *Laboratory Manual, Chemistry.*

Pigman, *The Carbohydrates, Biochemistry, Physiology.*

Schmidt-Neilsen, *Animal Physiology.*

Sorum, *Fundamentals of General Chemistry.*

White, *Chemical Background for the Biological Sciences.*

Young and Porter, *General Chemistry.*

VISUAL AIDS

Films

Coronet Instructional Films, 65 East South Water Street, Chicago, Ill. 60601.

Acids, Bases, and Salts. 21 min., 16 mm., color, sound.

Chemical Changes All About Us. 13½ min., 16 mm., color, sound.

Farm Film Foundation, 1425 H Street, N.W., Washington, D.C. 20005.

Careers in Chemistry. 13½ min., 16 mm., color, sound.

McGraw-Hill Book Company, Inc., Text-Film Department, 330 West 42nd Street, New York, N.Y. 10036.

Chemical Change. 12 min., 16 mm., color, sound.

Chemical Organization of the Cell. 30 min., 16 mm., color, sound.

From Atoms to Organisms. 30 min., 16 mm., color, sound.

Metabolic Diversity. 28 min., 16 mm., color, sound.

National Educational Television Film Service, Audio-Visual Center, Indiana University, Bloomington, Ind. 47401.

Carbon and Its Compounds. 30 min., 16 mm., black and white, sound.

U.S. Department of Agriculture, Graduate School, Room 1022, South Building, U.S.D.A., Washington, D.C. 20250.

Nutrition: Chemistry of Life. 53 min., 16 mm., black and white, sound.

Filmstrips and Slides

Dow Chemical Company, Audio-Visual Center, Abbott Road Building, Midland, Mich. 48641.

Chemicals Vital to Our Food Supply. 20 min., 35 mm., color, with disc.

Encyclopaedia Brittanica Films, 1150 West Wilmette Avenue, Wilmette, Ill. 60091.

Acids and Bases. 49 frames, 35 mm., color.

Applied Animal Nutrition

HOURS REQUIRED

Class, 3; Laboratory, 4. Prerequisite: *Applied Animal Biochemistry*

COURSE DESCRIPTION

This course is designed to develop an understanding of the essentials for good nutrition for livestock and poultry. The kinds of feeds commonly used, the suitability for the kind and age of the animals and birds, and the purpose of the feeding program are factors which the technician must consider as he prepares recommendations for specific feeding operations. The course will also develop an understanding of the kinds of feeds suitable for ruminants as compared with non-ruminants and will create an awareness of these differences when considering the economic aspects of livestock feeding.

The laboratory periods will be used in identifying suitable feeds in terms of nutrient requirements and price of ingredients, demonstrating effectiveness of feeds using pens of animals or birds, and in preparing feeding recommendations for a number of situations typical of the geographic area in which instruction is being given.

During the laboratory sessions, assign projects to students which will give them experience in preparing recommendations and reports of feeding trials and experiences in conducting feeding demonstrations using a variety of rations. Such activities may be coordinated with the *Communications II* class in which students prepare talks and make visuals to illustrate them.

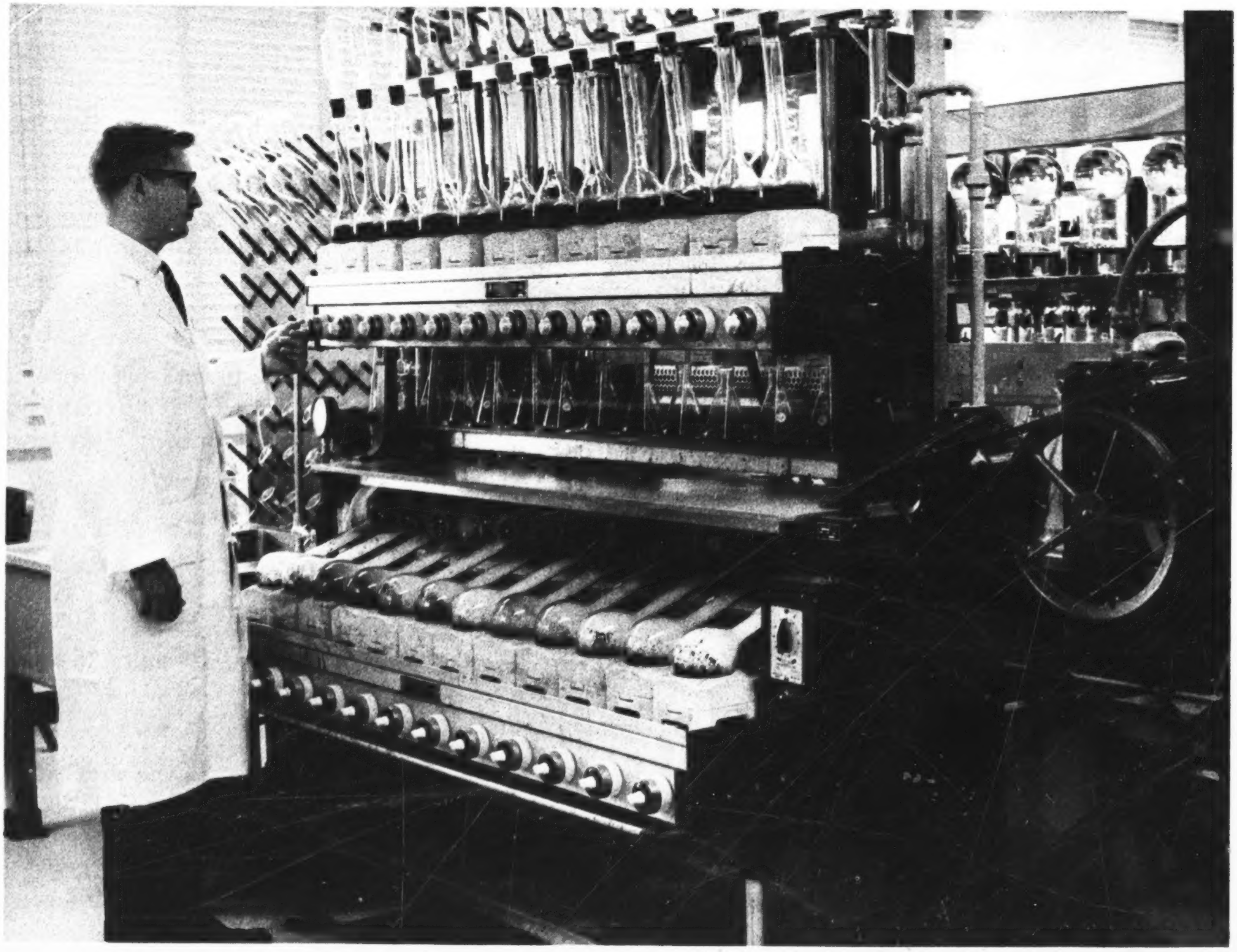

FIGURE 25.—Biochemistry technician tests samples of feed for crude protein.

MAJOR DIVISIONS

	Hours	
	Class	Laboratory
I. Classification of Feeds	8	12
II. Nutrients	10	12
III. Feed Efficiency	10	10
IV. Suitability of Feeds	8	10
V. Formulation of Feeds	12	20
Total hours	48	64

Division I. Classification of Feeds

A. Unit of Instruction
  1. Classification as:
    a. Roughages
    b. Concentrates
    c. Fiber
    d. Supplement
  2. Classification in terms of nutrients
    a. Proteins, amino acids
    b. Carbohydrates
    c. Minerals
    d. Fats
    e. Vitamins
  3. Classification in terms of energy values

B. Laboratory Projects

1. Take a field trip to a local feed dealer or farm supply center where feeds are sold. Make a list of the feeds which are offered for sale. If possible, obtain samples of these for use in the laboratory together with a copy of the information on the label of the prepared feeds.
2. List all farm-grown grains, forages, and other crops used for feed of livestock and poultry. Samples of these may also be obtained for use in the classroom.
3. Classify each of these feeds in terms of its energy value. In each case, list the feeds in order of the value for which they are classified. Roughages and concentrates may be placed in different classification lists.
4. Secure samples of hay and of each kind of silage produced in the area. Judge the quality of each of these, and arrange them in descending order in terms of their apparent feeding value.
5. Classify the samples of feeds that have been collected into groups in terms of content of specified minerals; for example, those feeds high in calcium and those high in iron.

Division II. Nutrients

A. Unit of Instruction
  1. Nutrients for growth
    a. Proteins
    b. Energy
    c. Minerals
    d. Vitamins—kinds
    e. Protein from non-protein sources
  2. Nutrients for production
    a. Milk and eggs
    b. Meat
    c. Wool
    d. Work

B. Laboratory Projects

1. Take a field trip to a dairy herd, beef feedlot, or other enterprise where livestock or poultry are being fed. Make a record of the kind and amount of hay, silage, or other roughage being fed. Estimate the quality of the roughages. Also determine the kind and quality of concentrates being fed. If commercially prepared feeds are fed, obtain data on them from the label. If farm-grown grains mixed with protein supplements are fed, record the amounts of each per ton of feed. Also estimate, as accurately as possible, the condition and quality of the farm-grown grains.
2. After returning to the laboratory, determine whether or not the ration is supplying the necessary nutrients including protein, net energy, fats, vitamins, and minerals. If it is likely that certain nutrients are lacking, make a list of these and suggest supplements to correct the deficiency.
3. The teacher assigns each member of the class to prepare a talk on nutrition of a specified kind of livestock. The talk may be planned as one to make before a group of farmers by a representative of a farm supply center. Students may design and

use charts, graphs, or other visuals to illustrate the talk. If possible, this project may be coordinated with *Communications II*, and the visual material may be developed as a project in that course. However, the subject matter and accuracy of the material should be cleared in the nutrition course.

4. Students may prepare a scrapbook of pictures and articles from magazines dealing with nutrition. A section of the scrapbook may deal with nutritional deficiencies and another section with results of good nutrition. Assignments may be made in terms of one kind of livestock or poultry, or in terms of all kinds of livestock common to the area.
5. Some sections of the United States lack certain micro-nutrients in the soil and in the feed crops grown on that soil; for example, there is a deficiency of cobalt in the soils of some areas. Students may secure an outline map of the United States and mark in the areas with such mineral deficiencies. These areas may be marked in colors and coded to the deficient mineral. When the map is completed, record the mineral supplement which should be provided the livestock in the area. Samples of the mineral may be mounted in vials on the map and the map saved for use in displays.
6. Secure baby chicks or laboratory animals, such as white rats. Divide these into two groups, and feed one group a normal ration and the second group a ration very deficient in protein. Record the rate of growth and the condition of the two groups over a period of 6 to 8 weeks. After the feeding period is completed, prepare a written report showing the plan of the demonstration, reviewing the available literature on the subject, reviewing the data, and presenting the conclusions concerning the demonstration.

   (*Note:* The project may be conducted as a class project, and it may be expanded as much as facilities and time will permit by the addition of pens of animals being fed rations deficient in other nutrients.)

Division III. Feed Efficiency

A. Unit of Instruction
   1. Relation to disease and parasite infection
   2. Relation to animal breeding
   3. Relation to management practices

B. Laboratory Projects
   1. Prepare a chart showing the pounds of feed per pound of gain which can be expected for meat-producing animals and poultry. For dairy cows and laying hens indicate the pounds of feed per 100 pounds of milk and pounds of feed per dozen eggs, respectively. From the study in biochemistry and from literature, make a list of feeding practices which may improve the feed efficiency of livestock and poultry.
   2. Take one or more field trips to livestock or poultry feeders in the area. Note the age of the livestock or poultry being fed and determine the feed efficiency of the operation. Compare the feed efficiency (pounds of feed per pound of gain) for younger animals as compared with older animals or birds of the same breed.
   3. Assume that you are a feed salesman who is interested in his customers making good use of the feed he supplies. Make a checklist of practices of the farmer which would affect the results he would get from your feed. Prepare a written report explaining the relationship of these practices to the successful use of the feed.
   4. If suitable housing is available, secure about 100 baby chicks or some weanling pigs, beef calves, or other meat-producing animals or birds. Feed them for a length of time depending on the kind of animals or birds that are used. Keep a careful record of all feed expended and of the gain in weight. Compute the pounds of feed per pound of gain. Compare the results with the average and with a recommended standard.

      Write a report of this demonstration as if carrying out the project as a feed salesman.

Division IV. Suitability of Feeds

A. Unit of Instruction

1. Ruminants—ability to:
    a. Digest bulky feeds
    b. Convert unsuitable materials into food for human consumption
2. Non-ruminants—horses, swine, poultry—use considerable amounts of material already suitable for human consumption
3. Relative cost of feeds suitable for ruminants and non-ruminants

B. Laboratory Projects

1. Prepare a list of feeds which are suitable for each age, class, and kind of livestock and/or poultry found in the area.
2. The teacher assigns students in pairs. Each member of the pair writes a question or problem dealing with suitability of feeds and gives it to his partner to answer. The students may assume the roles of customer and feed salesman. Each student is responsible for developing a real question and for finding a satisfactory answer to his partner's question. Questions and answers may be presented before the class. Following are two of many questions that might be developed:
    a. What can I feed my riding horses to make them have better coats of hair?
    b. What should I feed my beef breeding cows to carry them through the winter as economically as possible, consistent with production of a healthy calf crop?
3. Study the results of feeding trials in which free choice of several different feeds was offered to livestock or poultry. Did these tests indicate any differences in the palatability of the feeds? If possible, conduct a test with laboratory animals, pigs, calves, or chicks to test the palatability of two or more feeds. This may be done by offering the feeds by free choice or by offering one feed to one group of animals and another feed to a second group of the same kind of animals. In either case, keep a record of the amount of feed consumed and the rate of gain of the animals or birds.

Division V. Formulation of Feeds

A. Unit of Instruction

1. To balance roughages
    a. Hay, legumes, or grass
    b. Silage
    c. Other, as straw, hay, and silage combined
2. To meet specific needs as:
    a. Age of animal or bird
    b. Purpose of the feeding program
        (1) breeding stock
        (2) production of meat, milk, eggs, and wool
    c. Nutritional health of animals
        (1) minerals
        (2) vitamins
        (3) amino acids
    d. To balance farm-grown grains

B. Laboratory Projects

1. Assume you are a salesman/serviceman for a farm supply center in a beef-feeding area. A beef feeder who raises his own corn asks for advice on a feeding program. Plan a ration for him to use his corn and to supplement the corn with other suitable feeds to get his cattle ready for market as efficiently as possible. (*Note:* Additional information may be needed. If so, write out the questions, and for this project draft an answer as a basis for making recommendations.)
2. The teacher assigns individual students or small groups to prepare an exhibit in which ingredients for a complete daily ration for a specified kind of animal or bird are displayed; for example, for 100 laying hens, for a 1,600-pound dairy cow giving 80 pounds of 3.5 per cent milk daily, or other appropriate problems.
3. Plan a concentrate mixture to recommend to a man who has a herd of Holstein cows averaging 15,000 pounds of 3.5 per cent milk annually. The farmer has alfalfa hay and corn silage. Recommend the amount of roughage and the amount of concentrate to feed these cows. (*Note:* Variations of the above problem should be assigned to include beef, lambs, broilers, turkeys, laying hens, and swine and

to include systems of feeding practiced in the area. Include breeding herds and flocks as well as those being fed for market.)

4. Prepare a talk for a meeting of beef feeders explaining what can be done with rations to increase feed intake of the animal. Illustrate the talk with suitable visual material in the form of charts, pictures, or slides. (*Note:* Similar assignments may be made for any class of livestock or poultry common to the area.)
5. Assume you are a feed salesman/serviceman in a local farm service center. You are asked to call on a prominent livestock or poultry farmer to give advice on feeding. The animals (or birds) do not look thrifty, and are not producing as they should. In terms of the material to date in the courses, what information should be obtained before suggestions are made? Make a list of the possible nutritional or feeding problems which are likely to cause the trouble.

   Using these problems as the base, write the symptoms one might expect, and suggest a remedy in terms of a more suitable feeding program.

TEXTS AND REFERENCES

Acker, *Animal Science and Industry.*

American Feed Manufacturers Association, *Feed Production Handbook.*

———, *Proceedings of the Cornell Conference for Feed Manufacturers.*

Beaton and McHenry, *Nutrition: A Comprehensive Treatise.*

Blaxter, *The Energy Metabolism of Ruminants.*

Block, *Amino Acid Handbook: Methods and Results of Protein Analysis.*

Casida and others, *Relationships and Applications in the Production of Meat, Milk, and Eggs.*

Crampton, *Applied Animal Nutrition: The Use of Feedstuffs in the Formulation of Livestock Rations.*

Cunha, *Swine Feeding and Nutrition.*

E. I. Dupont de Nemours and Company, Inc., *Digest of Research on Urea and Ruminant Nutrition.*

Feed Bag Red Book, Buyers Guide.

Heuser, *Feeding Poultry.*

Jones and others, *The Effect of Storage of Grains on Their Nutritive Value.*

Maynard and Loosli, *Animal Nutrition.*

Midwest Feed Manufacturers Association, *Midwest Current Nutritional Problems Clinic, Kansas City, Missouri.*

Miller, *Composition of Cereal Grains and Forages.*

Miller and Hoefer, *Swine Technology; Introductory Animal Nutrition.*

Mitchell, *Is Animal Protein an Essential Constituent of Swine and Poultry Rations?*

Morgan and Lewis, *Nutrition of Pigs and Poultry.*

Morrison, *Feeds and Feeding.*

Munro and Allison, *Mammalian Protein Metabolism.*

National Academy of Sciences, *Composition of Concentrate By-Product Feeding Stuffs.*

———, *Joint United States- Canadian Tables of Feed Composition.*

———, *Nutrient Requirements of Beef Cattle.*

———, *Nutrient Requirements of Dairy Cattle.*

———, *Nutrient Requirements of Dogs.*

———, *Nutrient Requirements of Foxes and Minks.*

———, *Nutrient Requirements of Horses.*

———, *Nutrient Requirements of Laboratory Animals.*

———, *Nutrient Requirements of Poultry.*

———, *Nutrient Requirements of Rabbits.*

———, *Nutrient Requirements of Sheep.*

———, *Nutrient Requirements of Swine.*

Neurath, *The Proteins: Composition, Structure, and Function.*

Scheraga, *Protein Structure.*

Seiden, *The Handbook of Feed Stuffs: Production, Formulation, Medication.*

Sheehy, *Animal Nutrition.*

Sinclair, *Essential Fatty Acids.*

Tribble, *Feed Flavor and Animal Nutrition.*

Underwood, *Trace Elements in Human and Animal Nutrition.*

U.S. Department of Agriculture, Agricultural Research Service, *Effect of Soils and Fertilizers on Nutritional Quality of Plants.*

Wilkie, *Distillers Grain Manual.*

VISUAL AIDS

Films

Ralston Purina Company, 835 South Eighth Street, St. Louis, Mo. 63102.

The Rumen Story. 25 min., 16 mm., color, sound.

U.S. Department of Agriculture, Graduate School, Room 1022, South Building, U.S.D.A., Washington, D.C. 20250.

Nutrition: Chemistry of Life. 53 min., 16 mm., black and white, sound.

Soil Science I: Fertility

HOURS REQUIRED

Class, 2; Laboratory, 6.

COURSE DESCRIPTION

The course is designed as a basic course in soil science to be followed by *Soil Science II: Fertilizers*. The two courses in sequence will prepare students for employment as technologists in the fertilizer department of a farm supply center.

In this course students acquire knowledge and ability to judge the adaptability of the soil to crops and to understand the factors which need to be considered in determining the capability of the soil for crop production.

The course develops an understanding of the factors affecting plant growth. Plant nutrients will be considered as well as the special needs of some plants for micro-nutrients. The role of micro-nutrients in efficient crop production assumes greater importance as yields increase and new limiting factors of production are discovered.

Since this is one of the beginning courses in the suggested series, some of the laboratory projects could be related to other subjects to help the students develop an understanding of the requirements of the industry and the relationship to the subject matter. This may be accomplished by assigning preparation of reports, building displays, talks, and the like, as means of having students report the development of their knowledge of soil science. The emphasis will be on the development of knowledge of the subject matter of soils. At the same time, these activities may help integrate the content of various courses in the minds of the students.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Soil	2	6
II. Soil Classification	4	8
III. Land Use	2	8
IV. Soil Productivity Characteristics	2	8
V. Crop Adaptation	2	6
VI. Drainage and Irrigation	3	8
VII. Tillage	3	12
VIII. Liming, Soil Acidity, and Soil Alkalinity	3	10
IX. pH and Plant Adaptability	3	10
X. Plant Food Elements	3	10
XI. Diagnostic Methods for Determining Soil Deficiencies	3	10
XII. Factors Affecting Plant Growth	2	0
Total hours	32	96

Division I. Soil

A. Unit of Instruction

1. Formation of soil
2. Components of the soil

B. Laboratory Projects

The teacher assigns each student an area near the school which he may use for laboratory projects in this course. If the region is variable, it will be desirable for each plot to include each of the typical soil types and slopes.

1. Draw a map of the area indicating approximate boundaries of soil types, streams, and slopes. Indicate approximate degree of slope, vegetation, present field boundaries, roads, permanent buildings, wells, and other installations.
2. Secure samples of the soil types in the area, and place in sample bags or sealed cans. Be sure each sample is labeled to indicate its origin.
3. In the laboratory study each soil type that was collected and indicate on the map the origin of each soil sample.
4. Dry the soil samples in the air. Shake the soil sample through soil sieves, and examine and weigh the portion of the sample that accumulates on each screen. Compute the percentage by weight of each separate sample. Make a bar graph showing the accumulated portion of each separate sample. Compare the different soil types in the area. Also compare the soil types which other members of the class have collected.

Classify the soil in terms of estimated productivity. What is the relation of percentage of fine soil particles and the estimate of productivity?

Division II. Soil Classification

A. Unit of Instruction

1. Soil monoliths
2. Soil categories and types
3. Land use
    a. Soil management of each capability unit
    b. Agricultural uses versus other uses

B. Laboratory Projects

1. The teacher assigns pairs of students the task of making a soil monolith of at least one type of soil and to label the horizons of the soil. Each student may prepare a report indicating the origin of the soil from which the monolith was made and describing the characteristics of each horizon of the monolith in terms of sizes of particles, drainage of the soil, depth of surface layer, and estimated productivity of the soil.
2. Locate each of the soil monoliths in the soil triangle and label each one to indicate its type. Arrange the soil monoliths in the group according to their soil type. Examine each group and write a description of the soil type represented by the group of monoliths.
3. Take a field trip to an area which was assigned to one of the students. Classify the soils present in the area into one of the eight soil capability units into which the United States Soil Conservation Service classifies soils.
4. Locate the various soil capability units on the map of the area. Prepare a report indicating:
    a. Reasons for classifying each capability unit
    b. Recommendations for management of each capability unit
    c. Recommendations for the use of each capability unit; i.e., recreation, grazing, forest, row crops.

Division III. Land Use

A. Unit of Instruction

1. Agriculture versus other uses
2. Management of capability units
    a. Upland soils
    b. Organic soils

B. Laboratory Projects

Using the map of the assigned area, select parts of the area that are predominantly capability class No. 1, capability class No. 2, capability class No. 3. Prepare a suggested management program for each of the classes of land that should be used for farming. Indicate the kinds of crops, fertilization, land management practices to follow, and any special conservation practices needed.

Division IV. Soil Productivity Characteristics

A. Unit of Instruction

1. Slope
2. Stoniness
3. Erosion and erosion control measures
4. Texture
5. Moisture
6. Organic matter
7. Soil reaction
8. Available plant nutrients
9. Frost-free days

B. Laboratory Projects

1. For each of the identified land capability classes prepare a list of soil productivity characteristics. Be as specific as possible, indicating slope per hundred feet and very high to very low for such items as erosion or stoniness.
2. Secure weather data for the area showing average rainfall by months, average number of days of sunshine by months, average dates of last killing frost in spring and first killing frost in fall. Using these data, prepare a chart showing dates for planting spring crops and dates when the crops should be harvested in the fall. These data may be recorded on the map.

Division V. Crop Adaptation

A. Unit of Instruction

1. Soil factors
2. Climatic factors
3. Economic factors

B. Laboratory Projects
   1. Using the data accumulated from earlier laboratory projects, make a list of the crops adapted to the soils of the area for which the map was prepared. Are crops adapted to this soil type now growing on the appropriate soil?
   2. Make a list of the crops adapted to the area climate. Compare this list with the list for No. 1 above. Are some of the same crops on both lists? Are some crops adapted to the soil type but not to the climate and vice versa?
   3. Explain crop adaptation in terms of soil factors, climatic factors, and economic factors in writing. Explain why a combination of these factors determines what crops will be grown in an area.

Division VI. Drainage and Irrigation

A. Unit of Instruction
   1. Soil adaptation
   2. Relation to liming needs and alkali response
   3. Fertilizer response and means of application

B. Laboratory Projects
   1. On the map identify areas near the school where the limiting factor to high productivity is lack of water during the growing season. Prepare a plan for irrigating the land and recommend crops that would be most profitable under irrigation. Prepare an analysis of cost of irrigation and an estimate of increased income from the higher valued crops. Would it be feasible to invest in the irrigation system?
   2. An alternative to the above project would be to identify areas that would be more productive if drained. Plan a drainage system and prepare an analysis of costs and returns from its installation.
   3. Prepare a report with recommendations for applying fertilizer through irrigation water. Indicate the kind of equipment needed. Determine the methods of applying correct amounts of fertilizer. Include a plan for determining when supplemental plant food is needed during the irrigation season.

Division VII. Tillage

A. Unit of Instruction
   1. Minimum versus other tillage
   2. Relation of moisture to tillage practices
      a. Compaction of soil
         (1) crops and equipment
         (2) effect on yield
      b. Amount of moisture related to tillage methods

B. Laboratory Projects
   1. Prepare a series of flip charts showing a comparison between costs and returns for growing specified crops using minimum tillage and conventional tillage methods.
   2. Secure samples of soil such as clay, clay loam, silt loam, and others. Divide each sample into two parts and place each part in a shallow pan. Moisten the two portions of each sample with equal amounts of water. Stir one portion thoroughly and smooth the surface. Leave the other portion unstirred. Allow the samples to dry. Describe the condition of each portion for each type of soil. Compare the treatment given these soils with the practice of tilling the soil when the moisture content is high.
   3. Secure a summary of research data from an agricultural experiment station or from some other reliable source. Prepare a talk on tillage, using overhead transparencies made from the research data to illustrate the talk.

Division VIII. Liming, Soil Acidity, and Soil Alkalinity

A. Unit of Instruction
   1. Causes of soil acidity and soil alkalinity
   2. Importance of lime for:
      a. Modifying pH
      b. Plant food
   3. Liming and availability of plant nutrients
      a. Nitrogen
      b. Phosphorus
      c. Potassium
      d. Micro-nutrients
   4. Kinds and sources of lime
      a. Relative costs
      b. Relative value

B. Laboratory Projects

1. Use the samples of soil taken from the area you mapped earlier in the course, and run a pH test on each of these. Write an interpretation of these tests, indicating the relationship of the readings to the crops that might be grown successfully.

   For soils with low pH compute the amount of lime needed to raise the pH to successfully grow alfalfa or clover. Recommend the source of lime that would be most economical for the area. For soils with high pH compute the amount of acidifying materials to adjust pH to appropriate levels.

2. Prepare a demonstration which will illustrate the relation of lime to the availability of the major plant food nutrients in the soil.

3. Refer to laboratory project No. 1. Prepare a chart for display in a farm supply store to show customers the sources of lime suitable for use on their soil and the cost of each per unit of calcium.

Division IX. pH and Plant Adaptability

A. Unit of Instruction

1. Indicated by flora
    - a. Plants
    - b. Weeds
2. Optimum pH for optimum species growth
3. Choosing adapted crops versus modifying the pH

B. Laboratory Projects

1. Visit fields where the pH is quite variable. List the plants found on the soil in which pH is high and the plants on the soil in which pH is low; classify as crops or weeds.

   Map the low and high pH groups on the area map and indicate the weed plants and the crop plants characteristic of the areas.

2. Suggest a series of crops which might be grown on a soil with relatively low pH and a series which might be grown on a soil with pH 6.5–7.5. Prepare a written report in which appropriate crops are suggested for the soils of different pH ranges.

3. Prepare estimates of cost and income from the recommended crops for the low pH soils as compared with the costs and returns for modifying the pH of the soil and choosing crops adapted to a higher pH range.

Division X. Plant Food Elements

A. Unit of Instruction

1. Nitrogen
    - a. Function in plant growth
    - b. Forms of nitrogen suitable for plant food
    - c. Application of nitrogen
2. Phosphorus
    - a. Function in plants
    - b. Forms of phosphorus available
    - c. Application of phosphorus
3. Potassium
    - a. Function in plant growth
    - b. Forms of potassium
    - c. Potassium-magnesium ratio
    - d. Application of potassium
4. Sulphur
5. Micro-nutrients
    - a. Boron
    - b. Zinc
    - c. Iron
    - d. Manganese
    - e. Magnesium
    - f. Molybdenum
    - g. Copper (in organic soils)

B. Laboratory Projects

1. Grow some plants until they have produced true leaves. Transplant a plant to each of three jars filled with quartz sand. Keep the plants watered with solutions of plant food from which one of the nutrients is missing. Observe the plants and record the symptoms of nutrient deficiencies as they appear.

2. Take a trip to a field where crops and weeds can be observed. Check for evidences of plant nutrient deficiency. Record deficiency symptoms. Take soil and plant tissue samples from these spots.

3. Upon returning to the laboratory, check these soil samples and the plant tissues by applying appropriate tests. Compare the observations of plant deficiency with the results of the two tests. Is there a correlation between the two observations?

   Assume an outside salesman for a farm supply center had made the observations. Prepare a report for the manager in which the salesman recommends a procedure for selling fertilizer and/or lime to the owner of the land.

4. Prepare the materials needed to present the observations to the farm owner or manager to show him evidence of the need for fertilizer and lime.

Division XI. Diagnostic Methods for Determining Soil Deficiencies

A. Unit of Instruction
   1. Soil tests
      a. Sampling soil
      b. Soil testing laboratories
      c. Interpreting soil tests
   2. Tissue testing
   3. Strip plots
   4. Deficiency symptoms

B. Laboratory Projects
   1. Visit an official soil testing laboratory. Study the procedures followed in the laboratory and the report that is prepared on the soil samples submitted. Note also the procedures used in making the soil tests. Are conditions controlled more accurately than in the school laboratory?

   2. Each student may secure copies of several soil testing reports with the identification removed. Upon returning to their own laboratory, students may prepare fertilizer recommendations to meet the needs according to the soil tests made.

   3. Plant a series of demonstration plots near the school where the effectiveness of liming and of plant nutrients can be shown. Have adequate check plots and plan the size of plots to fit the machinery available for planting and harvesting.

   4. The teacher organizes the class into committees to plan and conduct an open house to observe the plots at appropriate times during the year. This program may simulate an open house that might be held at a farm service center to show demonstration plots which the center staff has set up for promotion of its products.

Division XII. Factors Affecting Plant Growth
Unit of Instruction
   1. Water
   2. Light
   3. Air
   4. Temperature
   5. Plant food
   6. Soil reaction
   7. Control of diseases
   8. Control of insects
   9. Genetic factors

TEXTS AND REFERENCES

Berger, *Introductory Soils.*

Buckman and Brady, *The Nature and Properties of Soils.*

Cook, *Soil Management for Conservation and Production.*

Donahue, *Soils: An Introduction to Soils and Plant Growth.*

Klingebiel and Montgomery, *Land Capability Classification.*

Knuti, Korpi, and Hide, *Profitable Soil Management.*

Russell, *Soil Conditions and Plant Growth.*

Worthen and Aldrich, *Farm Soils, Their Fertilization and Management.*

VISUAL AIDS

Films

Iowa State University, Audio-Visual Department, Ames, Iowa 50010.

Soil Test. 22 min., 16 mm., color, sound.

National Plant Food Institute, Film Department, 1700 K Street, N.W., Washington, D.C. 20006.

The Big Test. 15 min., 16 mm., color, sound.

Union Pacific Railroad, Omaha, Neb. 68101.

It's Time to Irrigate. 10 min., 16 mm., color, sound.

Filmstrips and Slides

University of Illinois, Vocational Agriculture Service, Urbana, Ill. 61801.

Collecting and Preparing Soil Samples for Testing. 36 frames, 35 mm., black and white, silent.

How and Why Do Soils Differ? 23 frames, 35 mm., black and white, silent.

Preparing and Using Soil Monoliths. 66 frames, 35 mm., black and white, silent.

Soil Moisture. 19 frames, 35 mm., black and white, silent.

Soil Structure. 69 frames, 35 mm., black and white, silent.

Soil Texture. 85 frames, 35 mm., black and white, silent.

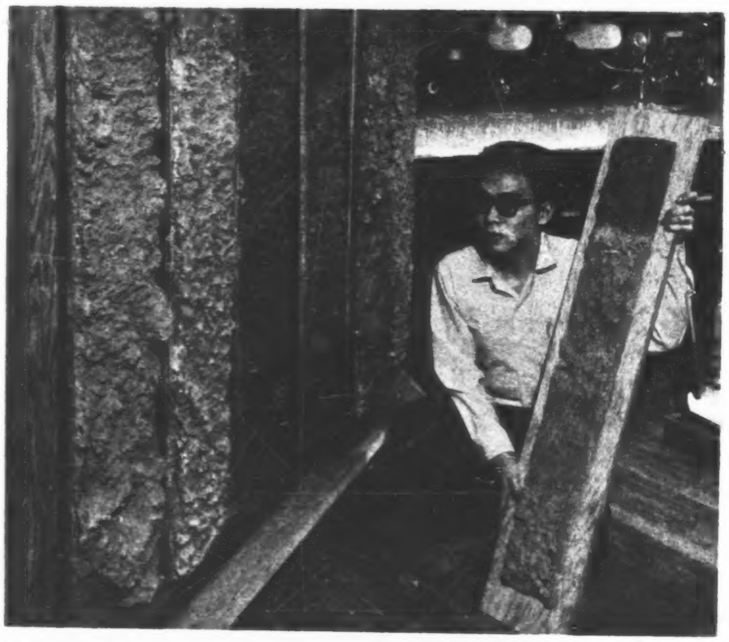

Figure 26.—Student learns soil technology from soil monoliths. He can recommend fertilizers and technical soil management based on his understanding of the soil.

Specialized Technical Courses

Agricultural Chemicals

HOURS REQUIRED

Class, 3; Laboratory, 2. Prerequisites: *Applied Animal Husbandry I* and *Crop Production.*

COURSE DESCRIPTION

This course is designed to acquaint the students with agricultural chemicals, primarily those used as herbicides, insecticides, fungicides, and nematocides and those used for internal and external parasites of livestock and poultry. Students need to be aware of the fact that increasing use of agricultural chemicals to control growth of plants, insects, and parasites has made problems of residues increasingly acute. Further research and new discoveries will make it necessary for the technician employed in the grain, feed, seed, and farm supply industry to have experience and ability in preparing and using agricultural chemicals. These procedures must be in accordance with recommendations of manufacturers and in line with the regulations of the State and Federal Food and Drug Administrations and of the U.S. Department of Agriculture.

The development of these abilities requires a thorough knowledge and ability to compute dilutions of materials either in water for sprays on weeds, crops, or fruits; in feeds or in drinking water for livestock; and in terms of active ingredients per acre.

Calibration of equipment to apply required amounts per acre is also an essential skill. This will require the ability to weigh and measure relatively small quantities on laboratory equipment.

The use of chemicals for control of internal and external parasites on livestock and poultry is also an important area of understanding for the technician in a farm supply center where such material is handled. Approved practices in the use of these materials, including methods of administering the material, dosage, and precautions to follow are all essential.

The instructional program that involves agricultural chemicals includes laboratory activities to provide students with actual practice and experience in preparing the materials for use, computing quantities of material to use, calibrating equipment, and applying materials following recommended procedures. Since the actual use of agricultural chemicals may require application during a season when classes are not in session, arrangements may be made for some practice to be given in the laboratory. This is particularly true for herbicides, insecticides, and fungicides, where application may be made on a very few plants in a growing bench.

For practice in use of chemicals for controlling internal parasites of livestock and poultry, it will be desirable to take field trips to feedlots or to herds and flocks on farms. The kind of livestock to be treated and the material to be used must be adjusted to the requirements of the area.

In all cases, teachers and students must keep in mind that the purpose of the instructional program, including the suggested laboratory activities, is to qualify the students to serve farmers and others who wish to purchase and use agricultural chemicals. It is important to stress this point in instruction and to make sure that students thoroughly understand the safe use and storage of appropriate chemicals.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Labels and Directions	8	10
II. Herbicides	14	6
III. Insecticides	4	3
IV. Fungicides	4	3
V. Nematocides	2	1
VI. External Parasites of Livestock and Poultry	6	3
VII. Internal Parasites of Livestock and Poultry	6	6
VIII. Safe Storage of Chemicals	4	0
Total hours	48	32

Division I. Labels and Directions

A. Unit of Instruction

1. Kinds of information on the labels
    a. List of ingredients
    b. Percentage of active ingredients
    c. Directions for application
        (1) rate
        (2) method
        (3) timing
        (4) cautions to be followed
2. Responsibility of employees to call to the attention of the customer:
    a. Directions on the label
    b. Contents of the package
    c. Methods of using
    d. Safety precautions (using masks, discarding empty packages, storing materials)

B. Laboratory Projects

1. Secure the labels from packages of insecticides, fungicides, nematocides, materials for controlling external parasites and for controlling internal parasites of livestock and poultry.
2. Make a list of these materials and indicate for each:
    a. Trade name
    b. Active ingredients
    c. Time, rate, and method of application
    d. Residue tolerance
    e. Safety precautions
3. Using the directions on the package, work out the computations to determine:
    a. The amount of the packaged material to provide a given amount of active ingredient
    b. Amount of packaged material to use per gallon or per pound when the directions indicate amount per 100 gallons or per ton
    c. Amount of insecticide to add per ton of fertilizer to provide recommended amount of insecticide per acre when fertilizer is to be applied at a given rate
    d. Amount of insecticide and fungicide to mix with 1 gallon of water for a spray for ornamental plants, when directions on the package are for given amounts of each per 100 gallons of water

Division II. Herbicides

A. Unit of Instruction

1. Types of herbicides
    a. Use of each
    b. Selectivity of each
    c. Residual effects of each
2. Application of each type
    a. Rate
    b. Timing of applications
    c. State and Federal laws and regulations
    d. Custom application
    e. Use of herbicide-fertilizer mixtures
        (1) computing formulation
        (2) compatibility of materials
        (3) computing rate of application
3. Sources of information regarding use of herbicides

B. Laboratory Projects

Some of the laboratory projects suggested here may require several weeks for completion. After the program gets underway, it may be possible for a class to observe results of demonstrations of a previous class, while at the same time starting a demonstration for use by a succeeding class.

1. Construct a chart showing for all vegetation the herbicides available for controlling weeds in each of the local crops and in lawns. Show commercial name of the product, active ingredient, time of application, rate of application, and any specific safety precautions to be observed.
2. Take a trip to observe the weed population in a crop. Identify the weeds in terms of the herbicides which would be effective in their control. Prepare a written recommendation for controlling the weeds by using a selective herbicide which will not damage the crop. After the recommendation has been checked and approved, pre-

pare the herbicide and make the application. Leave a check strip untreated and check results periodically. Record results and prepare a report of the total project. Be sure to include in the report the cost of treatment per acre and estimated returns per dollar of investment in the herbicide.

3. Select a lawn near the school, identify the weeds growing in the lawn, and prepare a project to demonstrate the use of herbicides to control the weeds and improve the lawn. If *Soil Science II* has been completed, include in the plans a program for demonstrating the effectiveness of fertilizer as well as herbicides. By applying the fertilizer in strips running one direction and the herbicide in strips running the other direction, effectiveness of the fertilizer, of the herbicide, and of the two in combination can be observed.

   Observe the results of the demonstration over a period of several weeks and prepare a report of the demonstration. The report represents a sample of one that an employee would prepare for the manager of a farm supply center.

4. Select an area where it is desirable to kill all vegetation; for example, in the driveway of a farm supply center, around the walls of an elevator, or other similar places. Select the proper chemical, measure the area, and compute the volume of prepared material needed and the amount of the chemical needed. Prepare the material and make the application. Observe the results over a period of 2 to 4 weeks and prepare a report on the results.

5. Prepare a recommended weed control program for the type of farm or ranch in the area.
   a. Determine or estimate the acreage of each crop.
   b. Compute the amounts of herbicide needed to apply the necessary amounts of actual chemical per acre and recommend the:
      (1) method of applying the herbicide
      (2) dilution to be made
      (3) rate of application of the mixture to provide the desired amount of active ingredient

Division III. Insecticides

A. Unit of Instruction
   1. Types of insecticides used to control:
      a. Sucking insects
      b. Chewing insects
      c. Pests on livestock and poultry
      d. Insects in stored grain
      e. Corn ear worm, corn borer, and others
      f. Flies
   2. Use of insecticides
      a. Where each is used
      b. What residual effects result
   3. Application of each insecticide
      a. Rate
      b. Timing of application—residue problems
      c. Laws and regulations governing application
      d. Custom application of insecticides
   4. Sources of information regarding use

B. Laboratory Projects
   1. Make a collection of common sucking insects of the area in which the school is located. Mount the insects, label each species with common and scientific names, and indicate one or more chemicals which might safely be used to control it. Note that some chemicals might be very effective in killing the insects but that they produce residues that are not allowable under State or Federal food and drug regulations.
   2. Make a collection of plant tissue damaged by chewing insects. Mount and label each specimen with the kind of insect that probably caused the damage. As an employee of a local firm that sells agricultural chemicals, prepare written recommendations for a farmer to help avoid serious damage from a prevalent chewing insect. Be specific as to material to use, method of preparing it, and method, time, and rate of application. Also provide an analysis of cost of material, number of applications, and the returns that the farmer might reasonably expect from

his investment. Include any precautions which are necessary to protect the farmer, livestock, crop, or the firm.

3. Working as a class, prepare a list of chewing insects that cause extensive damage in the area. Include insects that invade lawns, fruits, ornamental shrubs and plants, and farm crops. After the list is complete, students may work individually or in small groups to prepare charts showing the chemicals they recommend for control. Indicate the time, rate, method of application, and safety precautions to be observed.
4. Students may work individually or in small groups to prepare charts showing life cycles of chewing insects. Suggest the method of control most appropriate for use at the vulnerable point in the life cycle of the insect. (*Note:* Materials prepared in the above project may be saved and combined with materials prepared in other projects in this course for displays at open houses or for use in the salesmanship and communications courses.)

Division IV. Fungicides

A. Unit of Instruction
   1. Types of fungicides to control:
      a. Fungus diseases on plants
      b. Fungus infections of animals and poultry
      c. Seed-borne fungus infections
   2. Where each kind of fungicide is used
   3. The residual effects from the use of each kind
   4. Safety precautions in using each kind
   5. Application of each kind of fungicide
      a. Rate
      b. Timing of applications
      c. Tolerance to mixing with other chemicals such as insecticides

B. Laboratory Projects
   1. Take a trip to observe evidence of fungus infection in forage or grain crops, in fruits, and vegetables, in ornamentals, and in lawns and gardens.. Collect specimens of the infected plants and label the specimens, indicating the type of fungus infection.
   2. Secure untreated seeds known to be infected with a seed-borne fungus. Divide the seeds in two packages. Treat one package of seeds with a recommended fungicide. Plant both packages of the seed in a growing bench or in plots near the school. Care for the plants in the normal way and observe the effects of the seed treatment as the plants grow through the seedling stage to maturity. Prepare a report of the demonstration, making application of the results to the financial returns to be expected from seed treatment for a similar commercial crop.
   3. The teacher divides the class into groups. Each group collects additional specimens of fungus infection in a group of plants which are important locally; for example, one group might study fungi infecting the farm crops, and another group might study the fungi infecting the fruits. Each group of students may prepare a chart together with written recommendations for use at a farm supply center in the area. The chart would show the typical fungus infection; recommended material for control; time, rate, and method of application; and any special recommendations or cautions to be observed. The written recommendations would be prepared as a handout for the customers. They would also provide instructions for use of the recommended fungicide.

Division V. Nematocides

A. Unit of Instruction
   1. Types
   2. Use
   3. Application
   4. Sources of information regarding nematocides

B. Laboratory Projects

Take a trip to a farm or a greenhouse where arrangements have been made to demonstrate treating the soil for nematodes. Observe the methods and techniques used in making the treatment. Note the recommendations regarding temperature and soil conditions. Prepare a written report similar to one which would be provided to the manager of a farm

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supply center who had sent an employee on a similar field trip.

Division VI. External Parasites of Livestock and Poultry

A. Unit of Instruction
  1. Flies
    a. Species affecting livestock and poultry
    b. Materials used for control
    c. Techniques of using the materials
  2. Lice
  3. Mites
  4. Sources of information regarding use of control materials

B. Laboratory Projects
  1. List the major external parasites of livestock and poultry in the area. Take a trip to observe methods used by a producer to control one or more of the parasites affecting the animals or birds. In some areas this may mean a visit to a dairy herd; in another area, to a broiler plant or to a swine herd. Prepare a report of sound practices observed and recommended changes in the practices of the farmer.
  2. Select one kind of external parasite common locally. Make a chart or poster showing the life cycle of the parasite and indicate the point or points at which it may be controlled. Check with a local farm service center manager for materials available for use in control of the parasite and indicate on the chart each of the points where attacks can be made, the materials to be used, and the methods of using them.
  3. The class may take a field trip to observe dipping, spraying, or dusting livestock or poultry to control external parasites. Students may assist in preparing and applying the materials.

Division VII. Internal Parasites of Livestock and Poultry

A. Unit of Instruction
  1. Roundworms infesting livestock and poultry
    a. Species of roundworms affecting each kind of livestock and poultry
    b. Materials used to control roundworms
    c. Techniques of using the materials
  2. Flatworms infesting livestock and poultry
    a. Species of flatworms
    b. Materials used to control flatworms
    c. Techniques of using the materials
  3. Bots in horses
  4. Warbles in cattle
  5. Sources of information regarding use of chemicals for control

B. Laboratory Projects
  1. Visit a local livestock or poultry enterprise where students may participate in a thorough cleaning of the barns and/or equipment used in the production enterprise. Note the materials used for cleaning the buildings and equipment and the methods of using the materials. Prepare a report of the trip, indicating the purpose of cleaning the buildings and equipment, the materials used, and the methods of application. Note how the practice of cleaning the building and equipment may assist in controlling some species of parasites of livestock and poultry.
  2. Each member of the class may "post" an animal or bird to find internal parasites, particularly in the intestine. Birds or animals may be secured from local slaughter plants or from local producers. Students shall identify the type of internal parasites present. Each student is to prepare a written report indicating the types of parasites found and the probable source of infection.
  3. As an alternative to No. 2, take a field trip to a farm, a slaughter plant, or a veterinarian's laboratory where a veterinarian will demonstrate "posting" a bird or an animal to discover infestation with internal parasites. Samples of the parasites may be collected and preserved in a standard pickling solution.
  4. Students may work in small groups on selected assignments or as individuals to prepare charts showing the life history of each of the internal parasites common in the area. These might include tapeworms,

several species of roundworms, liver flukes, and trichina.

5. Each group of students may draft recommendations for the control of the parasite in the species of livestock with which the group is concerned. Recommendations may include control by several methods such as a drench, drinking water, feed, or by other means; as well as by sanitary practices such as drainage, sanitary equipment, and rotation of grazing land.
6. Take trips or tours with a recognized specialist in animal and/or poultry parasites (a veterinarian, Extension Service veterinarian from the State land-grant college, a specialist from the local farm supply store, or one of his suppliers) to observe local herds and flocks. Note the evidence of infestation with parasites, both internal and external. Record the symptoms which the specialist uses as evidence and the recommendations for avoiding or controlling the infestation.
7. Prepare a report of the above field trips or tours. Indicate for each case the symptoms observed and the recommended materials for control.
8. Assume the role of a serviceman for a farm supply center in the area. Select a livestock or poultry producer and prepare a program of parasite control to recommend to him. Indicate the materials needed, the rates of application, the precautions to observe, and the methods of use. Include in the report an analysis based on the best evidence available of the economic benefits to the producer if he will follow the recommendations.
9. Secure chicks, pigs, or other small animals that are infested with internal parasites. Place these in two groups in the laboratory. Treat one group with recommended materials and leave the second group untreated. Record feed consumed, rate of gain, and feed conversion for 8 to 12 weeks; and compute the differences in financial returns. Complete a report an employee would prepare if the project had been conducted for the manager of a farm supply center.

Division VIII. Safe Storage of Chemicals

Unit of Instruction

1. Storage places
   a. Farm store
   b. Supply warehouse
   c. On the farm
2. Disposal of empty containers
3. Factors related to safe storage—products and persons
   a. Humidity
   b. Temperature
   c. Chemical fumes
   d. Compatibility of chemicals
4. Facilities for storage

TEXTS AND REFERENCES

Andus, *Plant Growth Substances.*

Good and Taylor, *Chemical Control of Plant-Parasitic Nematodes.*

Hanna, *Handbook of Agricultural Chemicals.*

Manufacturing Chemists Association, *Agricultural Chemicals: What they Are, How They Are Used.*

Rose, *Crop Protection.*

Society of Chemical Industry, *Fungicides in Agriculture and Horticulture.*

Thomson, *Agricultural Chemicals.*

U.S. Department of Health, Education, and Welfare; Food and Drug Administration, *Livestock Men, Farmers, Feedlot Operators: When You Use Medicated Feeds, Follow Pre-Slaughter Withdrawal Rules.*

———, ———, "Medicated Feed Current Good Manufacturing Practice Regulations," *Code of Federal Regulations.*

———, ———, *A Message for Food Warehousemen, Poultry Men, Poultry and Egg Producers: When You Use Medicated Feeds, Follow Pre-Slaughter Withdrawal Rules.*

VISUAL AIDS

Films

Chevron Chemical Company, Ortho Division, 200 Bush Street, San Francisco, Calif. 94104.

Prescription for Safety. 18 min., 16 mm., color, sound.

Dow Chemical Company, Audio-Visual Center, Abbott Road Building, Midland, Mich. 48641.

Chemicals Vital to Our Food Supply. 20 min., 16 mm., color, sound.

The Enemy Underground. 12 min., 16 mm., color, sound.

Quack Grass—The Perennial Guest. 17 min., 16 mm., color, sound.

Thief in the Soil. 10 min., 16 mm., color, sound.

E. I. Dupont de Nemours and Company, Inc., Industrial Chemicals Division, Wilmington, Del. 19801.

Unseen Harvesters. 28½ min., 16 mm., color, sound.

Shell Chemical Company, 50 West 50th Street, New York, N.Y. 10020.

Insect Pests of Alfalfa. 15 min., 16 mm., color, sound.

Insect Pests of Corn. 20 min., 16 mm., color, sound.

Sterling Movies, U.S.A., 375 Park Avenue, New York, N.Y. 10022.

A New Day in Corn. 20 min., 16 mm., color, sound.

U.S. Department of Agriculture, Office of Information Services, Washington, D.C. 20250.

The Impact of Pesticides. 11 min., 16 mm., black and white, sound.

Safe Use of Pesticides. 21 min., 16 mm., color, sound.

Velsicol Chemical Company, 341 East Ohio Street, Chicago, Ill. 60611.

Soil Insect Control. 17 min., 16 mm., color, sound.

Filmstrips and Slides

Manufacturing Chemists Association, 1825 Connecticut Avenue, N.W., Washington, D.C. 20009.

Facts About Pesticides. 100 frames, 35 mm., color, sound—disc, 1 side, 12-inch, 33 1/3 r.p.m., 13 min.

Points on Pesticides. 77 frames, 35 mm., color, sound—disc, 1 side, 12-inch, 33 1/3 r.p.m., 13 min.

Applied Animal Husbandry I: Beef, Sheep, Dairy

HOURS REQUIRED

Class, 2; Laboratory, 4; Prerequisite: *Applied Animal Nutrition.*

COURSE DESCRIPTION

Technicians in the grain, feed, seed, and farm supply industry need an understanding and some skill in the husbandry techniques of the various livestock and poultry enterprises common to their area. This is essential if they are to make recommendations regarding the use of feeds, livestock, and poultry supplies; parasite and disease control materials and equipment; and other products distributed by their farm supply center.

This course is part of a sequence of two courses, each covering one semester. This course deals with husbandry and management techniques for beef, sheep, and dairy enterprises. A unit on feeding is included since it is an important aspect of animal husbandry. However, only limited time has been allocated to the subject matter of feeding, because it has been covered in the earlier courses entitled *Applied Animal Nutrition* and *Feeds, Ingredients, Additives, and Food and Drug Regulations.*

Instructors must be familiar with the geographic areas in which students are likely to find employment. They may then place greater emphasis on the study of the more important livestock enterprises of the area their students will be serving.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Management for Optimum Profit with Beef, Sheep, and Dairy Enterprises	4	8
II. Breeds and Breeding	6	12
III. Housing	4	10
IV. Disease and Parasite Control	4	10
V. Avoiding Accidents	5	10
VI. Feeding	1	0
VII. Systems of Management	8	14
Total hours	32	64

Division I. Management for Optimum Profit with Beef, Sheep, and Dairy Enterprises

A. Unit of Instruction

1. Factors of production essential in the enterprise
    a. Land
    b. Facilities
    c. Labor
    d. Management
2. Economic factors affecting management decisions
    a. Markets for products
    b. Sources of feeding, breeding, and production stock
    c. Adjusting feeding programs to markets and to grades of animals
3. The art of management
    a. Regularity
    b. Observation of individual animals
    c. Adoption and use of a system of feeding and husbandry

B. Laboratory Projects

1. Visit a local beef, dairy, or sheep enterprise. Determine the reasons the manager has chosen the breed, the practices followed in the management of the enterprise, the products produced, and the method of marketing.
2. Using the data obtained on the field trip, plan an alternative feeding plan for the kind of livestock and for the situation. For example, substitute more corn for alfalfa hay in feeding dairy cows, or barley for corn in fattening cattle or lambs.

    Prepare a budget showing an estimate of feed consumed, value of product, and returns over feed costs under the system observed and the alternative plan.
3. Assume you are employed in a local farm supply center. A customer asks for a recommended feeding program to prepare his cattle for market. Prepare an exhibit which shows a feeding and management program for the customer who has:
    a. Dairy-type steers
    b. 1,000 head of choice-grade beef cattle
    c. 5,000 head of cross-bred lambs

Division II. Breeds and Breeding

A. Unit of Instruction
   1. Breeds of beef cattle, dairy cattle, and sheep
      a. Adaptation of each breed to:
         (1) climate
         (2) parasites and diseases
         (3) markets for animals and products
         (4) feed supply
      b. Economical production of desired products
   2. Breeding of beef cattle, dairy cattle, and sheep for:
      a. Production
      b. Resistance to disease and parasites
      c. Adaptation to environment
      d. Market demands

B. Laboratory Projects
   1. Visit local beef, dairy, and sheep enterprises. Record the breeds of cattle and sheep observed, and compare the observations with reports showing breeds in the school area. Data may be secured from reports of dairy herd improvement associations (for dairy), artificial breeding organizations, breed associations, and other sources.

      Record the kinds of feeds used to feed livestock observed on these field trips. Identify the kind of production which is the objective of the enterprise; for example, beef calves on a range are being produced as feeder cattle, whereas beef calves in a feedlot are destined for slaughter. While these may be the same cattle, the production objectives of the two enterprises are different.
   2. Visit a slaughter house where arrangements have been made to evaluate cattle on the hoof and to examine and evaluate carcasses from these cattle. Prepare a written report showing the relation of the evaluation of the live animals with the carcass evaluation.
   3. Prepare a report in which a comparison is made between the carcasses observed and the carcasses of cattle that have been selected through several generations for a high percentage of the more costly cuts of meat.
   4. Prepare a chart showing a comparison between the returns over feed costs for dairy cows producing 14,000 to 16,000 pounds of milk and those producing 8,000 to 10,000 pounds of milk per year. If the differences in production are due to breeding, what are the returns per year for the better breeding? (Assume a 100-cow herd.)

Division III. Housing

A. Unit of Instruction
   1. Ventilation related to health and production
   2. Humidity related to health and production
   3. Lighting related to production
   4. Temperature range for optimum production
   5. Methods of heat loss
      a. Evaporation
      b. Radiation
      c. Convection
   6. Controlled environment
      a. Advantages
      b. Costs and returns
      c. Equipment needed

B. Laboratory Projects
   1. Plan housing for dairy, beef, or sheep enterprises. Assume the role of an employee of a farm supply center. Prepare a presentation to make to a farmer showing the kind of housing recommended for him. If you are planning housing for beef cattle to be fed in the feedlot for market, plan the layout of the pens and an efficient feeding system. Illustrate the presentation with charts and diagrams or other kinds of materials to show the lighting, ventilation, temperature control, and other environmental factors recommended.
   2. Observe a feeding system for dairy cows housed in a pen-type barn. Prepare a report showing how the system operates and how the manager is assured that all the cows will get enough feed to maintain production.

3. Observe the methods followed by livestock feeders using bulk feeds and feeding beef cattle with a mechanized system. Prepare a sketch of the system which one could use before a group of livestock feeders who are considering installation of such a system.

Division IV. Disease and Parasite Control

A. Unit of Instruction

1. Program for control of brucellosis
   a. Test and slaughter
   b. Vaccination
   c. Interstate shipment
2. Program for control of mastitis
   a. Operation of equipment
   b. Avoiding injury
   c. Test
3. Program for control of tuberculosis
   a. Test and slaughter
   b. Interstate shipment
4. Control of parasites
   a. External parasites
      (1) identification
      (2) treatment
   b. Internal parasites
      (1) methods of prevention
      (2) symptoms
      (3) treatment
5. Relationship with the veterinarian for control of disease and parasites

B. Laboratory Projects

1. At a laboratory, observe the testing of samples to detect brucellosis in dairy cows.

2. Assume the role of an employe of a farm supply center in the State. Prepare a newsletter to the customers which describes the benefits of having a brucellosis-free herd of cattle. Explain the losses that may accrue to them as a result of brucellosis in their herds. List reasons why the manager and staff in the farm supply center must be interested in the control of livestock diseases and parasites.

3. Visit a dairy herd to study the milking equipment. Check the vacuum line and the pulsators on the milker and observe the milking. Note how the cows were prepared for milking, the time the machine was on each cow, and the possible sources of irritation of the udder from the operation of the machine. Determine the relationship of mastitis incidence to udder irritation.

4. Assume the role of an employe in a farm service center. Prepare recommendations to make to a dairyman coming to the store asking for a remedy to treat his cows for mastitis. Include recommendations for medication, for checking equipment, and for examining and testing cows for indication of mastitis. In the statement, be sure to establish a relationship between the veterinarian and the business.

Division V. Avoiding Accidents

A. Unit of Instruction

1. Avoiding fires
   a. Heat lamps
   b. Lightning
   c. Electrical fires
   d. Smoking
2. Avoiding injuries
   a. Wires and obstructions
   b. Predators
3. Avoiding poisons and chemical hazards
   a. Sprays and spray materials
   b. Treated seeds and feed grains
   c. Residues
   d. Empty packages of poisonous products

B. Laboratory Projects

1. Take a trip to a dairy herd or a flock of sheep. List hazards which represent potential danger to the livestock, such as potential fire hazards, loose wires, nails, sharp projections, machinery or equipment into which animals may be pushed and bruised, and any other hazards you may discover.

2. Students may prepare a set of slides and a written script to describe common hazards to cattle or sheep. The class may outline the script, and committees may be assigned to get the slides for a specific section of the script.

3. The teacher assigns student committees to prepare an exhibit for display at a

community event describing potential hazards to cattle or sheep in the community and promoting practices to eliminate the hazards.

Division VI. Feeding

Unit of Instruction

1. Essential for production
2. Essential for health
3. Relationship to the course, *Feeds, Ingredients, Additives, and Food and Drug Regulations*

Division VII. Systems of Management

A. Unit of Instruction
   1. Beef cattle enterprise
      a. Cow-calf enterprise
      b. Beef feeding enterprise
         (1) length of feeding period
         (2) weights of finished cattle
         (3) markets for finished cattle
         (4) seasonal production of finished cattle
      c. Production of breeding stock
   2. Dairy cattle enterprise
      a. Purpose of production
         (1) fluid milk
         (2) butter, cheese, powdered milk, other
      b. Loose housing system
      c. Stanchion systems
      d. Production of breeding stock
   3. Sheep enterprise
      a. Purpose of production
         (1) wool
         (2) production of feeder lambs
         (3) lamb feeding enterprise
      b. Seasonal production
      c. Continuous production

B. Laboratory Projects
   1. Take trips to observe the management systems being followed by beef, dairy, and sheep husbandmen.
   2. Prepare a series of reports describing the systems which have been observed. Describe the daily routine of handling the enterprise in terms of feeding, milking of the dairy cattle, time for breeding for production of stock, and practices to avoid diseases and parasites.

      Also report the management practices in terms of plans to provide a continuous flow of product to market, showing adjustments for seasonal fluctuations of production or of demand. Include in the report information on seasonal fluctuations and availability of feed, range pastures, and other factors.
   3. The teacher organizes the students into pairs and assigns one student in the pairs the role of a beef, sheep, or dairy farmer or rancher, describing his situation in as much detail as possible. Then he assigns the other student the role of a salesman/serviceman for a farm service center interested in selling feed and supplies to the producer. This student then prepares a presentation he will make to the producer. This may be supplemented with sketches, pictures, research data, or other materials. The student assigned the role of producer prepares for the interview by finding all possible reasons for maintaining present status, particularly in terms of defending present programs and practices as being successful.
   4. The students make these presentations before a group of potential students in high schools, citizen groups, or at community gatherings where a demonstration of student activities is appropriate.

TEXTS AND REFERENCES

Acker, *Animal Science and Industry.*

Cassard and Juergenson, *Approved Practices in Feeds and Feeding.*

Cole, *Introduction to Livestock Production, Including Dairy and Poultry.*

Clark and others, *Demonstrations in Dairy.*

Crampton, *Applied Animal Nutrition: The Use of Feedstuffs in the Formulation of Livestock Rations.*

Davis, *Modern Dairy Cattle Management.*

Dykstra, *Animal Sanitation and Disease Control.*

Ensminger, *Animal Science.*

———, *Sheep and Wool Science.*

Iowa State University Press, *Midwest Farm Handbook.*

Juergenson, *Approved Practices in Beef Cattle Production.*

Kays, *Basic Animal Husbandry.*

Mahadaven, *Dairy Cattle Breeding in the Tropics.*

Mason, *World Dictionary of Breeds, Types, and Varieties of Livestock.*

Maynard and Loosli, *Animal Nutrition.*

McKinney, *The Sheep Book.*

Morrison, *Feeds and Feeding.*

Nordby, Beeson, and Fourt, *Livestock Judging Handbook.*

Seiden, *Insect Pests of Livestock, Poultry and Pets.*

Snapp and Neumann, *Beef Cattle.*

U.S. Department of Agriculture. *Cattle Lice: How To Control Them.*

VISUAL AIDS

Films

American Soybean Association, Hudson, Iowa 50643.

Tomorrow's Food Power. 27 min., 16 mm., color, sound.

Farm Film Foundation, 1425 H Street, N.W., Washington, D.C. 20005.

Dynamics of Animal Agriculture. 26 min., 16 mm., color, sound.

More Beef at Less Cost. 10 min., 16 mm., color, sound.

Modern Talking Picture Service, Inc., 3 East 54th Street, New York, N.Y. 10022.

Design for Better Beef. 38 min., 16 mm., color, sound.

University of Nebraska, Audio-Visual Instruction Center, Lincoln, Nebr. 68508.

Control of Cattle Lice. 8 min., 16 mm., black and white, sound.

Filmstrips and Slides

California Polytechnic College, San Luis Obispo, Calif. 93401.

Fat Lamb Projects. 65 frames, 35 mm., color, silent.

Applied Animal Husbandry II: Swine, Poultry, Horses

HOURS REQUIRED

Class, 2; Laboratory, 4. Prerequisite: *Applied Animal Nutrition.*

COURSE DESCRIPTION

Technicians in the grain, feed, seed, and farm supply industry need an understanding and some skill in the husbandry techniques of the various livestock and poultry enterprises common to their area if they are to make recommendations regarding the use of feeds, livestock, and poultry supplies; parasite and disease control materials and equipment; and other products distributed by their farm supply center.

This course is part of a sequence of two courses, each covering one semester. This course deals with husbandry and management techniques for swine, poultry, and horse enterprises. A unit on feeding is included since it is an important aspect of animal and poultry husbandry. However, very limited time has been allocated to it since the subject matter of feeding has been covered in earlier courses entitled *Applied Animal Nutrition* and *Feeds, Ingredients, Additives, and Food and Drug Regulations.*

Instructors must be familiar with the geographic areas in which students are likely to find employment. They may then place emphasis on the study of the more important livestock and poultry enterprises of the areas their students will be serving.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Management for Optimum Profit with Swine, Poultry, and Horse Enterprises	4	8
II. Breeds and Breeding	6	12
III. Housing	4	10
IV. Disease and Parasite Control	4	10
V. Avoiding Accidents	5	10
VI. Feeding	1	0
VII. Systems of Management	8	14
Total hours	32	64

Division I. Management for Optimum Profit with Swine, Poultry, and Horse Enterprises

A. Unit of Instruction

1. Review unit in *Animal Husbandry I* related to management for success.
    - a. Factors of production in the enterprise
    - b. Economic factors affecting management decisions
    - c. The art of management
2. Need for specialization in livestock production
    - a. Cost of facilities needed, reduce per-unit cost by larger volume
    - b. Need for large volume of production to keep costs per unit low
    - c. Need for specialized knowledge and ability

B. Laboratory Projects

1. Take a trip to a local swine, poultry, or horse enterprise. Determine the reasons why the manager has chosen the breed, the practices followed in the management of the enterprise, the products produced, and the method of marketing.
2. Using the data obtained in No. 1, plan an alternative feeding program for the kind of livestock and for the situation. For example, substitute more corn for wheat for feeding laying hens, or barley for corn for fattening swine or lambs. Prepare a budget showing an estimate of feed consumed, value of product, and returns over feed costs under the system observed and under the alternative plan.
3. Assume the role of an employe in a local farm supply center. A customer asks for a recommendation for a feeding program to prepare swine for market. Prepare an exhibit which shows a feeding and management program for the customer who has:
    - a. 25,000 laying hens
    - b. Feeder pigs of excellent breeding
    - c. 10,000 well-bred turkeys
    - d. A stable of 50 riding horses to be rented to vacationers.

Division II. Breeds and Breeding

A. Unit of Instruction

1. Breeds of swine, poultry, and horses
    a. Adaptation of each breed to:
        (1) climate
        (2) parasites and diseases
        (3) market demands and uses
        (4) feed supply
    b. Economical production of desired products
2. Special breeds—Repeat No. 1 for such breeds as are of economic importance locally.

B. Laboratory Projects

1. Visit local swine, poultry, or horse enterprises. Record the breeds of swine, poultry, and horses observed, and compare the observations with reports showing breeds in the area served by the school. Record the kinds of feeds you have seen used on these trips and identify the kind of production which is the objective of each enterprise.
2. Make arrangements to visit a slaughter house to evaluate swine on the hoof and to examine and evaluate carcasses of the same animals. Prepare a written report showing the relation of the live animal evaluation with the carcass evaluation.
3. Prepare a report in which a comparison is made between the carcasses that have been observed and the carcasses of swine that have been selected through several generations for a high percentage of costly cuts of meat.

Division III. Housing

A. Unit of Instruction

1. Factors affecting health or production
    a. Ventilation
    b. Humidity
    c. Lighting
    d. Temperature range
    e. Methods of heat loss
        (1) evaporation
        (2) radiation
        (3) convection
    f. Controlled environment
        (1) advantages
        (2) costs and returns
        (3) equipment needed

B. Laboratory Projects

1. Assume the role of an employe in a farm supply center. Prepare a presentation to make to a farmer recommending the kind of housing suitable for either swine, poultry, or horses. Illustrate the presentation with charts or other kinds of materials to show the lighting, ventilation, temperature control, and other environmental factors to be recommended.
2. Observe a local feeding system for swine. Prepare a report showing how the system operates and how the manager is assured that all the pigs will get enough feed to make maximum gains.
3. Observe the methods followed by a livestock feeder using bulk feeds and feeding poultry with a mechanized system. Prepare a sketch of the system one could use before a group of poultrymen who are considering installation of such a system.

Division IV. Disease and Parasite Control

A. Unit of Instruction

1. Program for control of swine diseases through:
    a. Vaccination
    b. Test and slaughter
    c. Observing interstate shipment regulations
2. Program for control of diseases in poultry through:
    a. Vaccination
    b. Medication
    c. Sanitation
3. Program for control of parasites through:
    a. Sanitation
    b. Treatment

B. Laboratory Projects

1. Visit a veterinary laboratory where swine or poultry are being examined for diseases. Observe evidence of such diseases as hog cholera, tuberculosis, and others prevalent locally.

2. Assume the role of an employe of a farm supply center in the State. Prepare a newsletter to be sent to customers which describes the benefits of a disease-free herd of swine or flock of poultry. Explain the losses that may accrue to the customer as a result of tuberculosis in his swine herd or poultry flock. List reasons why the manager and staff of the farm supply center must be interested in the control of livestock diseases and parasites.

3. Visit poultry enterprises to study the flock management practices. Note the practices for prevention of cannibalism in the flock. Also note the equipment used for maintaining high quality in egg production.

4. Assume the role of an employe in a farm service center. Prepare a recommendation to make to a poultryman who is producing broilers and who comes to the store asking for advice on feeding and sanitation practices. Include in the recommendations suggestions for sanitation, medication, equipment to be used, and also suggestions for feeding the flock. Be sure to establish a relationship with the veterinarian if diagnosing or treatment of diseases is to be recommended.

Division V. Avoiding Accidents

A. Unit of Instruction
   1. Avoiding fires
      a. Heat lamps
      b. Lightning
      c. Electrical fires
      d. Smoking
   2. Avoiding injuries
      a. Wires and other obstructions
      b. Predators
   3. Poisons and chemical hazards
      a. Sprays and fumigants
      b. Seeds treated with poisons mixed in feed grains
      c. Residues
      d. Empty packages which contained poison

B. Laboratory Projects

1. Visit a swine herd or a stable of horses. List all potential hazards such as fire hazards, machinery or equipment against which animals may be pushed and bruised, or any others you may discover.

2. Prepare a set of slides and a written script to describe common hazards to swine, poultry, or horses in the area. The class may outline the script, and a committee may be assigned to get the slides for a specific section of the script.

3. Assign students in committees to prepare an exhibit for display at a community event, describing potential hazards to swine, poultry, or horses in the community and promoting practices to eliminate the hazards.

Division VI. Feeding

Unit of Instruction
   1. Feeding for production
   2. Feeding for health
   3. Relationship to the course, *Feeds, Ingredients, Additives, and Food and Drug Regulations*

Division VII. Systems of Management

A. Unit of Instruction
   1. Swine enterprise
      a. Feeder pig
      b. Swine feeding
      c. Production of breeding stock
   2. Poultry enterprise
      a. Purpose of production
         (1) eggs
         (2) broilers
         (3) turkey meat
      b. Battery system
      c. Floor system
      d. Breeding stock production
   3. Horse enterprise
      a. Purpose of production
         (1) riding horses for recreation
         (2) riding horses for range work
         (3) ponies for pets
         (4) training school
      b. Breeding stock production

B. Laboratory Projects

1. Observe the management systems being followed by swine, poultry, and horse husbandmen.
2. Prepare a series of reports describing the systems which have been observed. Describe the daily routine of handling the enterprise in terms of feeding, time of breeding of the production stock, and practices to avoid diseases and parasites. Report on the management practices noted in terms of plans to provide a continuous flow of the product to the market, adjustment to seasonal fluctuation of production or of demand, seasonal fluctuations, and availability of feed and range pastures.
3. The teacher organizes the students into pairs and assigns one student in the pairs the role of a swine, poultry, or horse farmer or rancher, describing the situation in as much detail as possible. Then he assigns the other student the role of a salesman/serviceman for a farm service center interested in selling feed and supplies to the producer. This student then prepares a presentation he will make to the producer. This may be supplemented with sketches, pictures, research data, or other materials. The student assigned the role of producer prepares for the interview by finding all possible reasons for maintaining the present status, particularly in terms of defending present practices as being successful.
4. The students make these presentations before a group of potential students in high schools, citizen groups, or at community gatherings where a demonstration of student activities is appropriate.

TEXTS AND REFERENCES

Acker, *Animal Science and Industry.*

Amstutz and others, *Diseases of Swine.*

Anthony and Lewis, *Diseases of the Pig.*

Biddle and Juergenson, *Approved Practices in Poultry Production.*

Bundy and Diggins, *Poultry Production.*

Card, *Poultry Production.*

Carroll, Krider, and Andrews, *Swine Production.*

Cole, *Introduction to Livestock Production, Including Dairy and Poultry.*

Dykstra, *Animal Sanitation and Disease Control.*

Ensminger, *Animal Science.*

———, *Swine Science.*

Heuser, *Feeding Poultry.*

Iowa State University Press, *Midwest Farm Handbook.*

Kays, *Basic Animal Husbandry.*

Marsden and Martin, *Turkey Management.*

Maynard and Loosli, *Animal Nutrition.*

Miller and Hoefer, *Swine Technology; Introductory Animal Nutrition.*

Morrison, *Feeds and Feeding.*

Nordby, Beeson, and Fourt, *Livestock Judging Handbook.*

Seiden, *Insect Pests of Livestock, Poultry and Pets.*

Springer Publishing Company, *Poultryman's Manual: Flock Management and Chicken Diseases.*

Tobin and Arthur, *Dynamics of Adjustment in the Broiler Industry.*

VISUAL AIDS

Films

Farm Film Foundation, 1425 H Street, N.W., Washington, D.C. 20005.

Increased Income From Hogs. 10 min., 16 mm., color, sound.

Life Cycle Housing for Hogs, 20 min., 16 mm., color, sound.

Iowa State University, Film Production Unit, Ames, Iowa 50010.

Livestock Insects. 19 min., 16 mm., color, sound.

Probing for Profits. 18 min., 16 mm., black and white, sound.

Michigan State University, Audio-Visual Center, East Lansing, Mich. 48823.

Hog Feeding. 14 min., 16 mm., black and white, sound.

Modern Talking Picture Service, Inc., 3 East 54th Street, New York, N.Y. 10022.

Acres of Cages. 20 min., 16 mm., color, sound.

Ohio State University, Audio-Visual Center, Columbus, Ohio 43212.

This Business of Turkeys. 17 min., 16 mm., color, sound.

Ralston Purina Company, 835 South Eighth Street, St. Louis, Mo. 63102.

Hen Makes an Egg. 18 min., 16 mm., color, sound.

Union Pacific Railroad, Department of Livestock and Agriculture, Omaha, Nebraska 68101.

Saving Little Pigs. 10 min., 16 mm., color, sound.

University of Minnesota, Audio-Visual Educational Service, Minneapolis, Minn. 55101.

Hogs for Profit. 35 min., 16 mm., color, sound.

University of Wisconsin, Audio-Visual Library, Madison, Wisc. 53706.

Producing Quality Eggs. 14 min., 16 mm., color, sound.

Filmstrips and Slides

California Polytechnic College, San Luis Obispo, Calif. 93401.

Fat Lamb Projects. 65 frames, 35 mm., color, silent.

University of Illinois, Vocational Agriculture Service, Urbana, Ill. 61801.

External Parasites of Swine. 48 frames, 35 mm., black and white, silent.

Crop Production

HOURS REQUIRED

Class, 2; Laboratory, 6.

COURSE DESCRIPTION

Efficient crop production is basic to the success of the grain, feed, seed, and farm supply industry. It is through the application of modern technology to the production of crops that the unprecedented food and fiber production of the Nation has developed. Technicians who are employed in the grain, feed, seed, and farm supply industry need a sound basic knowledge of crop production practices and techniques, since they are called upon to recommend and supply the materials that make production possible. These employees often recommend the kinds and varieties of crops to grow, the fertilization and liming practices, the cultural practices, as well as the harvesting and storage practices to be followed. Problems of disease, insect, and weed control need to be recognized and appropriate chemicals suggested for prevention or control.

Crop Production is designed to provide the basic training needed by the technician. Instructors must be aware of the relationship of *Crop Production* to *Soil Science I, Soil Science II, Communications I, Communications II,* and other courses. To understand crop management one must recognize the importance of fertilizers, chemicals, and harvesting techniques. However, the specific technical aspects of these must be included in other courses in the program.

The laboratory projects suggested for *Crop Production* deal with a number of student activities which may require several laboratory sessions to complete. This will make it possible for students to carry forward two or more projects.

It is also suggested that some projects in *Crop Production* be related to work in other courses such as *Communications I* and *Communications II.* This will require close coordination and cooperation between instructors of the courses, but it will provide students with more realistic situations for their laboratory work.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Food Production	2	6
II. Classification of Crops	4	32
III. Factors Used in Choosing a Species and the Variety	6	12
IV. Crop Management Practices	8	12
V. Harvesting Grain and Feed Crops	5	10
VI. Certified Seed	2	12
VII. Plant Growth Factors	5	12
Total hours	32	96

Division I. Food Production

A. Unit of Instruction
  1. World
    a. Population growth
    b. Needs
    c. Land resources and production potential
  2. United States, State, and local
    a. Trends
    b. Types of farms and management (farm business)
    c. Economical farms

B. Laboratory Projects
  1. Compare world population trends, food production trends, and land resources available for food production. Draw conclusions regarding the need for food over the next 25 to 50 years.
  2. Secure summaries of farm account records for the local type of farming area or for the farm enterprises common to the area. Analyze these records and compare the high-income group with the average (or with the low-income group) in terms of accepted measures of farm management efficiency.

Division II. Classification of Crops

A. Unit of Instruction
  1. Forage
    a. Legumes
      (1) uses
      (2) varieties

- b. Grasses
  - (1) uses
  - (2) varieties
- 2. Kinds of grain crops
  - a. Varieties
  - b. Uses: Seeds, feeds, food, commercial products, and by-products
- 3. Cash crops and special crops (feed, food, commercial products, and by-products)
- 4. In terms of nutrients
  - a. Meat versus crop products
  - b. Dairy versus crop products
- 5. Land use
  - a. Agricultural versus other
  - b. Acre value and cropping management

B. Laboratory Projects

1. Collect and label samples of crops. Indicate identifying characteristics of each.
2. Make a chart showing recommended varieties of each crop for the area.
3. Indicate classification of crops according to use for:
   - a. Grazing
   - b. Roughage
   - c. Grain for feed, food, other
4. Identify and label weeds commonly found in the crops grown in the locality. (These may be dried and mounted as a permanent collection.) Indicate the crop in which each weed is a serious problem and recommend a method of control. If the use of an herbicide is recommended, indicate the time, rate, and method of application, together with all safety practices to be observed.
5. Select a major crop grown in the locality. Make a chart or diagram showing the utilization of the crop and the end products derived from it.
6. Prepare a written report showing the factors one would consider and the sources of information he would use if he were asked to make recommendations to a farmer-customer of a local farm supply center. As part of the report, describe a typical farm situation for the area and prepare a set of recommendations as to crops to raise, varieties to use, and management practices to follow. Indicate in each case the basis for the recommendations. (*Note:* This project may be carried over into Units III and IV, since some of the information needed for a thorough job will be covered in these units.)

Division III. Factors Used in Choosing a Species and the Variety

A. Unit of Instruction

- 1. Growing season
  - a. Frost-free days
  - b. Length of days
  - c. Night and day temperatures
- 2. Land factors
  - a. Soil types
  - b. Soil surface contour
  - c. Soil moisture
  - d. Annual and growing season precipitation
  - e. Wind and water erosion
- 3. Economic factors
  - a. Demand
  - b. Value per acre
  - c. Ease and cost of marketing

B. Laboratory Projects

1. Select two different geographic areas of the United States. Show the factors influencing the choice of major crops for each area. Do this by preparing a table with charts and maps or by writing a report.
2. For the local area indicate the differences in crops grown and list for each the factors which cause the differences in choices.
3. Prepare a series of reports showing the data for factors used in choosing species and variety. For some items show the range. (*Example:* Range in temperature, first week in June in different years.) Based on these data indicate the species and varieties of crops recommended locally.

Division IV. Crop Management Practices

A. Unit of Instruction

- 1. Rotation or crop sequence
- 2. Fertilizer recommendations
  - a. Soil testing
  - b. Tissue tests
  - c. Flora observation—crop and weeds

- d. Plant nutrients
    - (1) required by plants for maximum yields
        - (a) lime
        - (b) fertilizers
        - (c) micro-nutrients
    - (2) time, placement, and method of application
- 3. Control of plant diseases and insects
    - a. Chemical controls
        - (1) State and Federal regulations
        - (2) food and drug control
        - (3) methods of using chemicals
            - (a) rate
            - (b) time
            - (c) safety practices
    - b. Cultural controls
        - (1) drainage—irrigation
        - (2) seed-bed preparation and management practices
    - c. Weed control
        - (1) cultivation
        - (2) plant competition
        - (3) herbicides
            - (a) function
            - (b) time-rate
            - (c) caution
            - (d) cost and return
            - (e) plan of use
    - d. Seeding
        - (1) quality of seed to use
        - (2) use of treated seed, handling left-over treated seed
        - (3) rate or plant population—date, depth

B. Laboratory Projects

1. Observe crop management practices of local successful farmers. Note the sequence of crops grown and the practices followed with regard to fertilizers, green manure, and cover crops. Secure data regarding yield and quality of each of the major crops grown.
2. Using the data secured on the field trips, compute the amount of plant nutrients required by the crops to produce the yield and quality observed. For one of the farmers visited, prepare a recommendation for the use of fertilizer and lime which will either maintain or improve his average yields. Include some suggested recommendations regarding soil tests and tissue tests to be used and the time, method, and rate of application of fertilizer and lime. Make an analysis of the financial returns the farmer might expect by following the recommendations.
3. Prepare a display to show farmers the safe use of chemicals they commonly use to control plant diseases and/or insects on their crops. In the exhibit, emphasize the need to adhere to State and Federal regulations regarding the use of the chemicals.
4. Assume you are employed by the manager of a local farm supply center and have been asked to prepare a script for a set of slides or a TV program to describe recommended cultural practices for one of the major crops in the area. If possible, combine this project with one in a communications class. Scripts may be evaluated by students, teachers, and farm service center managers. If facilities are available, one or more may be accepted for production.
5. Collect soil from the surface, and 1 inch, 2 to 3 inches, 4 to 5 inches, and 7 to 8 inches below the surface. Place each of these samples approximately 1 inch deep in a box or shallow pan, and place in a seed germinator or other place where growing conditions are good. Protect each sample from drying out. Count the weed plants that appear in one week and in two weeks. Prepare a report showing the relation of germination of weeds to the depth they are found in the soil. Include in the report an analysis of what happens when soil is worked after an herbicide is applied.

Division V. Harvesting Grain and Feed Crops

A. Unit of Instruction

- 1. Equipment
    - a. Operation
        - (1) quality of product
        - (2) efficiency and effective operation
    - b. Maintenance
- 2. Conditioning crops at harvest
    - a. Drying crops in the field and on the farm

b. Storing crops on the farm
    - (1) relation of moisture and temperature to grain quality
    - (2) ventilation and aeration
    - (3) types of storage
        - (a) silos
        - (b) hay mows
        - (c) bins
        - (d) granaries

B. Laboratory Projects

1. Visit a farm machinery dealer where harvesting equipment for the major grain and feed crops of the area is available. Using the operator's manual for the machines, determine adjustments which may be made to control quality of each product and those for efficient operation of the equipment.
2. Observe equipment and facilities needed on a farm for storing grain and feed crops. Record the types of storage available, the aeration and drying equipment recommended, and the methods of using the equipment.
3. Prepare recommendations for harvesting and storing a selected major grain or feed crop locally. Include recommendations regarding moisture content at harvest and method of storing and handling on the farm. Indicate capacities of equipment and facilities needed for specified amounts of grain or feed crops under the different conditions that are likely to be encountered.

Division VI. Certified Seed

A. Unit of Instruction

1. State program
2. Field inspection
3. Processing equipment
4. Eligible processors
5. Laboratory analysis and certification

B. Laboratory Projects

1. Observe and practice field inspection of a crop being grown for certified seed. Note the field conditions which would be considered by an official inspector. If possible, the teacher should invite an official inspector to check and evaluate the observations of the class members.
2. Visit a certified seed producer, and note the equipment he uses and the practices he follows in handling seed before delivery.
3. Prepare a report showing the step-by-step procedure and process followed in producing, processing, and distributing certified seed. Indicate the points where inspections and analyses are made and the safeguards used to assure a superior product.

Division VII. Plant Growth Factors

A. Unit of Instruction

1. Water
2. Air
3. Light
4. Temperature
5. Plant food
6. Soil reaction
7. Control of disease and insects
8. Genetic factors

B. Laboratory Projects

1. Using a growing bench in a greenhouse or a lighted growing bench in a laboratory, select plants of major crops of the area for demonstrations such as the following:
    - a. Response of plants to water (range from very dry to flooding)
    - b. Response of plants to light (length of light periods, frequency of light periods, intensity of light, color of light, etc.)
    - c. Response of plants to air (cover some plants to exclude air and add CO_2 for some)
    - d. Response of plants to temperature (level of temperature, changes in temperature)
    - e. Response of plants to plant food (level of fertility, response to micro-nutrients)
    - f. Response of plants to pH of the soil

TEXTS AND REFERENCES

Bonner and Galston, *Principles of Plant Physiology.*

Burger, *Laboratory Studies in Field Crop Science.*

Christensen and Kaufmann, *Spoilage in Stored Grain.*

Clark and Churchill, *Demonstrations in Farm Crops.*

Galston, *The Life of the Green Plant.*

Hughes, Heath, and Metcalfe, *Forages.*

Hughes and Henson, *Crop Production.*

Leonard and Martin, *Cereal Crops.*

Meyer, Anderson, and Bohning, *Introduction to Plant Physiology.*

Rose, *Crop Production.*

Sutherland, *Report of Seventeenth Hybrid Corn Research Conference.*

U.S. Department of Agriculture, *Power To Produce.*

———, *Seeds.*

———, Economic Research Service, *The Effect of Weather and Technology on Corn Yields in the Corn Belt, 1929–1962.*

Walsh and others, *Corn from Bag to Bin.*

Whythe, *Crop Production and Environment.*

Wilsie, *Crop Adaptation and Distribution.*

Wilson, *Grain Crops.*

Woodford and Evans, *Weed Control Handbook.*

VISUAL AIDS

Films

American Soybean Association, Hudson, Iowa 50643.
Grow Soybeans Not Weeds. 26 min., 16 mm., black and white, sound.

Farm Film Foundation, 1425 H Street, N.W., Washington, D.C. 20005.
Agricultural Research and You. 28 min., 16 mm., color, sound.
Breeding Corn for Today's Farming. 15 min., 16 mm., color, sound.
Great Story of Corn. 30 min., 16 mm., color, sound.

Geigy Agricultural Chemicals, Saw Mill River Road, Ardsley, N.Y. 10502.
A Way With Weeds. 22 min., 16 mm., color, sound.

National Plant Food Institute, 1700 K Street, N.W., Washington, D.C. 20006.
Bread From Stone. 17 min., 16 mm., color, sound.

North Dakota State Wheat Commission, Bismarck, N.D. 58510.
Hard Red Spring Wheat. 20 min., 16 mm., color, sound.

Shell Chemical Company, 50 West 50th Street, New York, N.Y. 10020.
Insect Pests of Alfalfa. 15 min., 16 mm., color, sound.

U.S. Department of Agriculture, Office of Information Services, Washington, D.C. 20250.
Safe Use of Pesticides. 21 min., 16 mm., color, sound.

Filmstrips and Slides

American Potash Institute, 1102 16th Street, N.W., Washington, D.C. 20036.
Safe and Efficient Fertilizer Placement. Forty 2 x 2 frames, 35 mm., color, silent.

Feeds, Ingredients, Additives, and Food and Drug Regulations

HOURS REQUIRED

Class, 3; Laboratory, 4. Prerequisites: *Applied Animal Biochemistry* and *Applied Animal Nutrition.*

COURSE DESCRIPTION

This course is designed to build on the content of the course, *Applied Animal Nutrition,* and to develop the ability to formulate feeds for livestock and poultry. Consideration is given to the factors of choice of ingredients in relation to cost and suitability for the purpose intended. Upon satisfactory completion of the course, students will be able to formulate feeds for all kinds, ages, and classes of livestock and poultry. Hens being fed for egg production and dairy cows being fed for milk production will require feeds suited to these purposes as contrasted with the feeds required for feeding beef cattle, swine, or lambs for slaughter.

The students will be given a working knowledge of feed medication, including a study of feed additives approved for use; of how to obtain clearance for the use of additives; and of solving problems of chemical residues in meat, milk, and eggs.

The Division of Industry Advice, Bureau of Education and Voluntary Compliance, U.S. Food and Drug Administration, has assisted in the preparation of a suggested list of topics which needs to be covered in relation to the program of food and drug regulations. These are included in Division V of the outline. It is suggested that instructors cover these items thoroughly and that references and subject matter of this unit be kept up to date.

The practice of farmer-customers asking the staff at the local feed mill to prepare a feed to supplement the roughage available on the individual farms is likely to continue for many years. This practice will require that the technician in the farm supply center must understand the relationship of roughages and farm-grown grains and be able to provide a sound supplemental feed for the customer.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Ingredients	6	12
II. Feed Additives	6	12
III. Feeds: Their Formulation	9	12
IV. Planning Rations for Various Classes of Livestock and Poultry	9	24
V. Regulations for the Industry	18	4
Total hours	48	64

Division I. Ingredients

A. Unit of Instruction
   1. Selection of ingredients for:
      a. Nutrients
      b. Fiber
      c. Palatability
      d. Cost
   2. Selection of alternative ingredients to meet the label specifications
      a. Price differential
      b. Availability
      c. Processing costs
   3. Selecting grades of an ingredient to meet label specifications—emphasize the effect of:
      a. Variety
      b. Climatic conditions
      c. Harvesting and storage conditions
      d. Moisture
   4. Use of computer in formulating feeds

B. Laboratory Projects
   1. Use the list of feeds sold in the local farm supply center, which was prepared for *Applied Animal Nutrition.* Add to the list as many feeds as possible considering by-product materials available. Secure prices for each of the feeds on the list. Classify the feeds in terms of major nutrients, fiber, minerals, and vitamins each would provide.
   2. The teacher divides the class into groups of two or three students, and assigns each group the development of an exhibit of feed ingredients which will furnish one of the major nutrients which is:
      a. High in energy

   b. High in a specific mineral
   c. Important for some other characteristic

3. The above exhibit may be expanded to indicate the relative cost of a nutrient from each of the ingredients in the exhibit.
4. Students may use the list of feed ingredients they developed in No. 1 to prepare charts which show the palatability of each feed ingredient for a specified kind of livestock or poultry. As an alternative, a display to indicate palatability by means of cartoons of animals eating a palatable feed and avoiding an unpalatable feed might be made.
5. Students may be assigned one class of livestock for which they should list series of feed ingredients. These should show alternative roughages, grains, sources of proteins, energy feeds, and minerals. Emphasis should also be placed on palatability and suitability for the animals assigned. The assignment can be carried out by preparation of charts, by exhibits of samples of the feeds with appropriate labels, or by other methods which the instructor or students may devise.

Division II. Feed Additives

A. Unit of Instruction
   1. Minerals
      a. Minerals commonly fed; their purposes
      b. Relation of soil fertility to minerals in feed
   2. Medication and antibiotics
      a. Ingredients commonly added
         (1) purpose of each
         (2) cautions to use
      b. Relation of medication in feeds to diagnosing animal health conditions
         (1) Food and Drug Administration regulations
         (2) relation to veterinarian
         (3) liability of the firm

B. Laboratory Projects
   1. Prepare a list of minerals commonly deficient in feed ingredients and the kinds of animals needing these minerals. Indicate the chemical compound or special feed ingredient which may be used to provide the needed mineral. Display samples of sources of the needed minerals. Label each one to indicate the mineral it will furnish in the feed.
   2. Formulate a mineral mixture for specific kinds of livestock common in the area. Weigh the amounts of the chemical compounds which might be mixed in a ton of feed to provide the needed minerals. For livestock needing a mineral mixture fed separately, weigh and place in separate containers in a display the amounts of each compound needed to provide 100 pounds of suitable mineral mixture.
   3. Check with the manager of the local farm supply center to determine:
      a. The materials he offers customers to meet the mineral requirements for livestock and poultry. Make a record of the kinds of material, the minerals provided, and the recommended methods of using the materials.
      b. The minerals listed on the labels of the commercial feeds sold by the farm supply center.
   4. The teacher assigns groups of two or three students to prepare skits which present the facts regarding the use of medication in feeds for livestock and poultry. One group may show the relation of the manager at the farm service center to the veterinarian regarding medication in feeds. Another may show the relation of Food and Drug Administration regulations to the use of antibiotics or other additives in the feed, including permits required for using feed additives. Other groups may select other types of problems, and their skits may be used to provide the answers they have found through their study. The skits may be presented before local businessmen, local veterinarians, and other guests.
   5. The students prepare a chart showing the common ailments and hazards to beef animals on the range. The chart may list the common ailments and be accompanied by pictures or sketches of the characteristic effect on the animal and a picture or sketch of the cause; for example, one of the items might consist of a picture of a plant poisonous to cattle and a sketch of

the characteristic symptom in the animal, together with the name of the plant.

Division III. Feeds: Their Formulation

- A. Unit of Instruction
  - 1. Balancing feeds
    - a. Provide needed energy
    - b. Provide desirable ratio of protein, carbohydrate, and fat
      - (1) amino acids
      - (2) energy values
    - c. Provide suitable bulk and fiber
  - 2. Adjusting feeds to available roughage
  - 3. Providing needed minerals and vitamins
  - 4. Selecting suitable supplements for farm-grown grains and roughages
    - a. Using prepared pre-mix
    - b. Using industry-manufactured concentrates
- B. Laboratory Projects

  Build on the materials developed in the laboratory projects in Divisions I and II of this course. Develop a tentative feed for a class of livestock or poultry common in the area. Select the ingredients which will provide the needed nutrients and minerals palatable and suitable for the kind of livestock or poultry being considered.

Division IV. Planning Rations for Various Classes of Livestock and Poultry

- A. Unit of Instruction
  - 1. Dairy cattle
    - a. Milking cows
    - b. Calves
    - c. Heifers
    - d. Dry cows
    - e. Sires
  - 2. Beef cattle
    - a. Beef cow herd
    - b. Range cattle
      - (1) winter feeding of dry range breeding herds
      - (2) winter feeding of cow herds in humid regions
    - c. Feedlot cattle
    - d. Calves
    - e. Sires
  - 3. Swine
    - a. Brood sows
    - b. Weanling pigs
    - c. Feeder pigs
    - d. Sires
  - 4. Sheep
    - a. Feeder lambs
    - b. Brood ewes
    - c. Range ewes and lambs
    - d. Rams
  - 5. Poultry
    - a. Laying flock
    - b. Broilers
    - c. Turkeys
  - 6. Horses
- B. Laboratory Projects

  The purpose of this division of the course is to develop the ability to formulate rations for many different kinds of situations encountered in feeding livestock and poultry. The laboratory portion of this unit should be devoted to the computation of rations for many different situations and for all kinds of livestock and poultry. Ages of the animals or birds being fed, purposes for feeding, markets supplied, and relative costs and effectiveness of ingredients should be considered. The instructor will provide students many problems emphasizing points to be taught and providing practice in the development of rations.

Division V. FDA Regulations for the Industry

- A. Unit of Instruction
  - 1. Development of U.S. Food and Drug Laws
  - 2. Responsibilities of the Food and Drug Administration
  - 3. The Federal Food, Drug, and Cosmetic Act
  - 4. FDA activities to promote compliance with the law
  - 5. FDA organization and liaison with other agencies
    - a. Trade organizations
    - b. Federal government agencies
    - c. State feed and food agencies
  - 6. Food additive regulations
    - a. Sub-part A, General
    - b. Sub-part B, Food and Food Products
    - c. Sub-part C, Drugs
    - d. Sub-part D, Hazardous Substances
  - 7. Registration of medicated feed mixers

8. Drug classifications, new and not new; certifiable antibiotics and minerals
9. Current drug regulations
10. Certifiable antibiotic regulations
11. Application form, FD 1800
12. Exemptions for antibiotic drugs
13. Feed mill inspections—checklist
14. Good manufacturing practices
15. Packaging and labeling
16. Color treatment of seeds
17. Pesticide tolerances and exemptions
18. Food and drug pesticide residue program

B. Laboratory Projects

Secure a set of the following forms of the United States Food and Drug Administration:

1. FD 472. Carriers Receipt Sample
2. FD 482. Notification of Inspection
3. FD 483. List of Observations
4. FD 484. Receipt of Samples
5. FD 1800. Medicated Feed Application

Each student may be assigned a situation related to the feed manufacturing industry for which he will complete each of the forms. Each student may prepare a report explaining the purpose of the Food and Drug Administration and the use of the forms for fulfilling their purposes.

TEXTS AND REFERENCES

Altschul, *Processed Plant Protein Feedstuffs.*

American Feed Manufacturers Association, *Particle Reduction, Proportioning, Mixing, Contamination Control.*

———, *Pelleting and Related Subjects.*

———, *Short Course for Local Feed Mills, 1962.*

Bassen, *The FDA Organization.*

Beeson, "Formulating High-Urea Supplements," *Feed and Feeding Digest.*

Brackett, *Feeding Aueromycin to Poultry.*

Brensike and Vosloh, *Price Spreads for Formulated Poultry Feeds in Illinois.*

Cassard and Juergenson, *Approved Practices in Feeds and Feeding.*

Crampton, *Applied Animal Nutrition: The Use of Feedstuffs in the Formulation of Livestock Rations.*

Distillers Feed Research Council, *Distillers Feeds: Their Importance to the U.S. Economy.*

Eichers and Hangas, *Mobile Feed Milling by Cooperatives in the Northwest.*

Ewing, *Poultry Nutrition, for the Use of Feed Manufacturers, Feed Dealers, Feed Salesmen and Service Men, Veterinarians, Hatcherymen, Breeders and Poultrymen.*

Feed Additive Compendium.

Feed Production School, Inc., *Proceedings of the Feed Production School, Kansas City, Missouri.*

Golden, *Registration of Medicated Feed Producers.*

Hangas, *Mobile Feed Milling by Cooperatives in Michigan and Wisconsin.*

Harold, *New Drug and Certifiable Antibiotic Regulations.*

Herder, *Farmers' Preferences for Formula Feeds.*

Hodges, *Livestock-Feed Relationships, 1909–1963.*

Hoeting, *Packaging, Labeling and Related Subjects.*

The Premarketing Clearance Concept.

Hutton, King, and Boucher, *A Least Cost Broiler Feed Formula.*

Lee, *FDA's Inspection and Regulatory Program.*

McFarland, *Federal-State Relations.*

Merck and Company, Inc., *Microingredients in Feeds, a Mixing Manual.*

Moore, *Feed Milling and Mixing in North Central Texas.*

Morrison, *Feeds and Feeding.*

Nakada, *Symposium on Current Good Manufacturing Practices, Regulations, Medicated Feeds.*

National Academy of Sciences, *Composition of Concentrate By-Product Feeding Stuffs.*

Schneider, *Feeds of the World: Their Digestibility and Composition.*

Seiden, *The Handbook of Feed Stuffs: Production, Formulation, Medication.*

Sherwood, *The Feed Mixers Handbook.*

Titus, *The Scientific Feeding of Chickens.*

U.S. Department of Health, Education, and Welfare; Food and Drug Administration, "Antibiotic Drugs," *Federal Register.*

———, ———, *FDA, What It Is and Does.*

———, ———, *FDA's Pesticide Residue Program.*

———, ———, Federal Food, Drug, and Cosmetic Act: General Regulations for Its Enforcement, Title 21, Part 1.

———, ———, "Food Additive Regulations," *Code of Federal Regulations.*

———, ———, *General Principles of Food Sanitation.*

———, ———, *Handling of Food Grains.*

———, ———, "Medicated Feed Current Good Manufacturing Practice Regulations," *Code of Federal Regulations.*

———, ———, *A Message for Food Warehousemen, Poultry Men, Poultry and Egg Producers: When You Use Medicated Feeds, Follow Pre-Slaughter Withdrawal Rules.*

———, ———, *Poultrymen, Poultry and Egg Producers: When You Use Medicated Feeds, Follow Pre-Slaughter Withdrawal Rules, Keep Drug Residues Out of Poultry, Meat and Eggs.*

———, ———, *The Veterinarian and FDA.*

Vosloh, *Ingredient Handling by Feed Manufacturers: Capital and Labor Requirements.*

Wilcox, *Caution in Using Feed Additives for Laying Birds.*

———, *Caution in Using Feed Additives for Swine.*

VISUAL AIDS

Films

Farm Film Foundation, 1425 H Street, N.W., Washington, D.C. 20005.

More Beef at Less Cost. 10 min., 16 mm., color, sound.

Modern Talking Picture Service, Inc., 3 East 54th Street, New York, N.Y. 10022.

Design for Better Beef. 38 min., 16 mm., color, sound.

U.S. Department of Agriculture, Office of Information Services, Washington, D.C. 20250.

Safe Use of Pesticides. 21 min., 16 mm., color, sound.

Filmstrips and Slides

U.S. Department of Health, Education, and Welfare, Educational Media Branch, Washington, D.C. 20250.

FDA Regulations and Inspections in the Feed Industry. Fifty-five 2 x 2 slides, color, mimeographed script.

Grain Grading

HOURS REQUIRED

Class, 1; Laboratory, 6. Prerequisite: *Crop Production*

COURSE DESCRIPTION

The primary purpose of this course is to develop the ability to grade grain of all kinds. While emphasis will be placed on the kinds of grain grown in the State, students should be able to grade any kind of grain grown in the United States with a high degree of accuracy by the time they have finished the course.

The class sessions in this course will develop understanding of the aspects of grain grading promulgated by the U.S. Department of Agriculture, some of the Food and Drug Administration regulations regarding grain, and the like. The trading rules and arbitration system of the Grain and Feed Dealers National Association should be understood by the students in terms of their effects upon the industry and in terms of their acceptance by the industry.

The students should become increasingly aware of the relationship of practices they studied in *Crop Production* to the quality of grain produced. This may be studied in terms of the economic returns at the farm and also in terms of its effect on the costs and returns at the country elevator. The effect of production practices will be traced through the industry to the ultimate consumer.

The students will investigate other relationships to help them discover the effect of environmental factors on the grade of grain produced. Such factors as amount of sunshine during the growing season, rainfall, flooding, temperature, and frosts at harvest time may be considered. The effect of summer fallow, irrigation, and other practices as they affect environmental conditions may also be studied.

It is suggested that students in laboratory sessions make up samples of grain to represent specific grades. This is an excellent device to help them to recognize grade determining factors. It is also a satisfactory way for the instructor to accumulate a variety of samples quickly. After the initial collection of samples has been gathered, the assignment may continue and the samples thus obtained used to renew the collection. Acquiring the ability to determine accurately the grade of grain will take many hours of practice with numerous samples of the different kinds. As much time as possible should be devoted to this activity.

Successful instructors in this field suggest laboratory exercises in grain grading early in the course, with work in contamination, moisture tests, and other factors affecting grades being introduced from time to time. This procedure will help students to recognize and evaluate their own progress and will minimize the feeling of repetition that may develop as a result of constant practice without the introduction of new factors.

Instructors suggest that from time to time students be given the opportunity to review the grading of species already covered, as well as being introduced to new species. In this way, students are more likely to recognize the application of such factors as moisture, contamination, and weight per bushel in grading various species.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Grain Grades	6	10
II. Grading Wheat	1	20
III. Grading Corn	1	20
IV. Grading Barley	1	10
V. Grading Oats	1	8
VI. Grading Soybeans	1	8
VII. Grading Rye	1	6
VIII. Grading Other Crops	4	14
Total hours	16	96

Division I. Grain Grades

A. Unit of Instruction

1. Federal grades and their function.
2. Establishing and/or changing the grade or factors
3. Federal grade on a car of grain
4. Appeal and its use
5. Loading a car for shipment

6. Recording grades
7. Use of light for grading
    a. Equivalent of north light
    b. Sun and shadow
    c. Color blindness
8. Sampling grain for grading
    a. Car
    b. Truck
    c. Barge
    d. Mechanical sampling
9. Theory of sampling
10. Computing percentages for grain grading
11. Effect of temperature changes on grade of grain
    a. Movement of grain from cold to warm areas
    b. Relation of temperature and moisture to condition of grain
12. Cause, effect, and control of each factor determining a grade

B. Laboratory Projects

1. Visit an elevator where grains grown locally are purchased from farmers. Observe the sampling of a truckload of grain and the procedure used by the staff in the elevator to determine the grade.
2. Prepare a chart showing the factors to be considered in grading grain grown locally. Use pictures or drawings on the chart to aid in identifying the factors to be considered in the grading.
3. Prepare a series of cards on which are mounted:
    a. A specific class of grain
    b. Common damage found in the grain
    c. Types of contaminants found in the grain

    These can be mounted in a thin line of glue applied to the card. Each student should complete a file of all of the classes of grains with some of the common factors determining grade.
4. The students receive a series of factors without samples of grain. Using the factors, they may determine the grade of grain represented by the factors. The purpose of this project is to acquaint students with the factors determining grade and to emphasize the need for clear and accurate thinking regarding the factors.
5. Secure a report from one of the major grain markets and determine the prices of grains of specified grades.
6. Observe the loading of a car of grain. Upon returning to the laboratory, prepare a written report on the preparation of the car for loading.
7. Visit an elevator or grain storage where each student may take a sample of grain and/or seed. Secure samples from sacks of seeds, from trucks of grain being delivered to the elevator, from a storage bin, or from other sources. Each student must be able to take an acceptable sample for determining the grade of grain for analyzing.
8. The students should use a chart to check themselves or other class members for evidence of color blindness and to be assured that they can recognize colors in the grains they will be grading. No attempt at diagnosis should be made. If there is suspicion of color blindness, the student should be referred to a physician. Each student should examine the samples of grain under different lighting conditions in the laboratory. The teacher should make records of the observations by the students so that they will recognize the necessity of using an appropriate light for grading grain.

Division II. Grading Wheat

A. Unit of Instruction

1. Classes of wheat
    a. Characteristics of each class
    b. Use or purpose of each class
2. Market grades of wheat
3. Factors determining grade of wheat
    a. Test weight and cause of variation
    b. Moisture test and influence of moisture on grade
    c. Contamination
        (1) rodent damage
            (a) identifying damage and contamination
            (b) preventing damage
        (2) insect damage
            (a) kinds and identification

            - (b) types of damage
            - (c) prevention of insect damage
            - (d) treatment of grain for insects
            - (e) use of X-ray to detect insect infestation
        - (3) seed treatments
            - (a) materials used
            - (b) dangers to man and animals
            - (c) why found in commercial grain
    - d. Other factors—cause, control, and commercial evaluation
- 4. Special grades—function, control, and commercial evaluation

B. Laboratory Projects

1. Begin grain grading practice with samples of wheat. After becoming proficient in this, begin to work with samples of other kinds of grains. The instructor may obtain grain of known grades from grain exchanges or from grain submitted for arbitration. These may be used for testing purposes. "Boderline" samples should be used near the close of the semester after students have become quite proficient at grain grading.

   The instructor should work closely with each student during this part of the laboratory program. The students should check the grades they have placed on each sample of grain with the instructor prior to the close of each laboratory period.

2. Secure samples of grain from local farm sources. Check as many samples as possible to identify rodent damage and contamination.

3. Examine several samples of each kind of grain for insect damage and for the presence of insects.

4. After several samples have been examined for rodent contamination and for insect damage, examine samples for both contaminants at the same time. Record the findings for each sample and check findings with the instructor at the close of each class period.

5. After becoming familiar with the many grade-determining factors, grade as many samples as time will allow. If official grades are available for the samples, check your grades against the official grades.

6. Make up samples of wheat to a specified grade. A quantity of wheat may be made available to the class and each student asked to make his sample using this wheat as a base. Store each sample in an appropriate container and label it. The students (or the instructor) may index these samples for future use in quizzes or for class work.

Divisions III Through VIII.

A. Unit of Instruction

Repeat the same format as in Division II for wheat. Students need to become familiar with similarities and differences in the factors determining grades of each species and class of grain produced in the United States.

B. Laboratory Projects

1. The teacher should provide opportunity for reviewing the grading of each species at frequent intervals. The laboratory periods must progressively introduce factors determining grade and provide opportunities to identify the newly introduced factors. These new factors must be evaluated in comparison with those the students learned to identify earlier.
2. Secure and prepare samples of grains in the way suggested for the laboratory projects in Division II. This project should help emphasize the factors determining grade for each class of grain. Include the following in the project:
    - a. Use a common base to prepare samples showing specific grades of grain.
    - b. Prepare and catalog several samples showing the grade and the factors which determined the grade. The instructor needs two to three dozen samples representing each class. This will make it possible for students to work on new samples at each laboratory session. The experience of developing the samples will help students fix grade characteristics in their minds.

TEXTS AND REFERENCES

Christensen and others, *Malting Barley Grade Factors.*

———, *Spring Wheat Grade Factors.*

Kansas State University, Department of Flour, Feed and Milling Industries, *Conference on Stored Grain Insects and Their Control.*

Musil, *Identification of Crop and Weed Seeds.*

U.S. Department of Agriculture, Agricultural Marketing Service, *Grain Grading Primer.*

———, Consumer and Marketing Service, *Agricultural Marketing Act of 1946, As Amended.*

———, ———, *Official Grain Standards of the United States.*

———, ———, *United States Grain Standards Act, As Amended.*

Whitehair, Bohannon, and Enix, *Corn Kernel Damage.*

Whitehair, Cleavinger, and Enix, *Soybean Kernel Damage.*

Whitehair and Enix, *Oat Kernel Damage.*

VISUAL AIDS

Films

U.S. Department of Agriculture, Office of Information Services, Washington, D.C. 20250.

Eradicating the Khapra Beetle. 13 min., 16 mm., color, sound.

Grain Sampling. 30 min., 16 mm., color, sound.

Filmstrips and Slides

Seedburo Company, 618-626 West Jackson Boulevard, Chicago, Ill. 60606.

Corn—Grain Grading. Fifty-seven 2 x 2 slides, color, 35 mm.

Grain Sorghums. (Number of frames not given) 35 mm., color.

Oats—Grain Grading. (Number of frames not given) 35 mm., color.

Soybeans—Grain Grading. Fifty-eight 2 x 2 slides, 35 mm., color.

Wheat—Grain Grading. Seventy-four 2 x 2 slides, 35 mm., color.

U.S. Department of Agriculture, Office of Information Services, Washington, D.C. 20250.

Grain Sanitation. 54 frames, 35 mm., black and white, silent.

University of Minnesota, Audio-Visual Library, Minneapolis, Minn. 55101.

Reducing Losses From Grain Storage. Ten 2 x 2 slides, 35 mm., color.

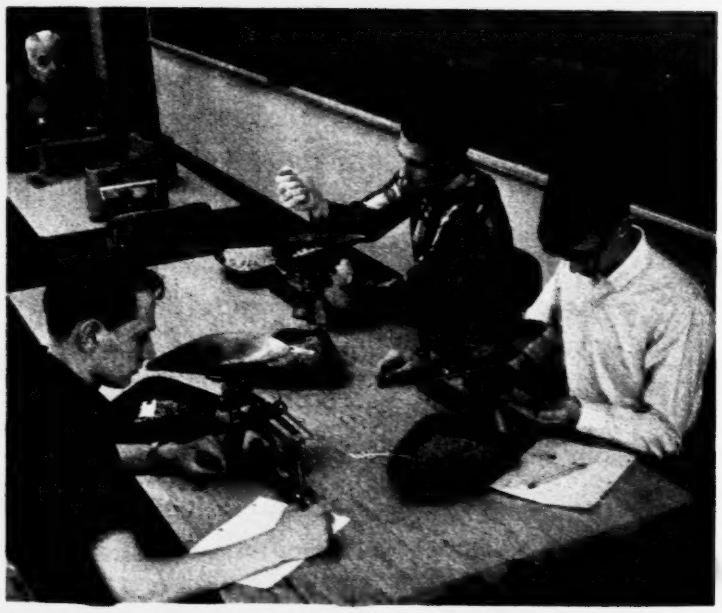

FIGURE 27.—These students are studying to become highly skilled grain grading technicians.

Grain Handling, Warehousing, and Merchandising

HOURS REQUIRED

Class, 3; Laboratory, 4. Prerequisite: *Agricultural Economics and Marketing.*

COURSE DESCRIPTION

The course is designed to acquaint the students with the complete cycle of movement of grain from the farm through the country elevator, grain storage, and merchandising to the consumer.

Problems of grading and pricing for purchase from the farmer, keeping in touch with the markets, hedging, and merchandizing are covered in the course. Units dealing with the problems of storing grain are included. These include such subjects as grain sanitation, aeration, drying, and cleaning.

Units on hedging are included in the course entitled *Agricultural Economics and Marketing,* as well as in this course. Duplication will be avoided by teaching the theory and practice of the use of the futures markets in *Agricultural Economics and Marketing* and the use of hedging as a tool of the elevator operator in *Grain Handling, Warehousing, and Merchandising.* Safety practices are included as part of the program, particularly as they apply to grain storage, cleaning of bins and equipment, and fire prevention.

Trade and arbitration rules are included to help students to develop an understanding of the means by which the industry sets its own standards. It has been stated that the grain and feed industry exhibits high ethical standards in its business transactions. This is made possible by the acceptance of the Trade and Arbitration Rules to which the members of the Grain and Feed Dealers National Association subscribe.
In the units dealing with safety, grading at the country elevator, and others, instructors and students will find a close relationship to units in other courses. Duplication of content is not intended. For example, the unit on fire prevention in this course will deal with practices necessary to avoid fires in grain storages. The unit on fire prevention in *Physical Facilities and Care of Equipment* will deal primarily with methods of preventing and of extinguishing fires, particularly in terms of preventing fires caused by faulty equipment. Selection and use of equipment for extinguishing fires is included in the course entitled *Physical Facilities and Care of Equipment.*

Staff members of the U.S. Food and Drug Administration have contributed a major portion of the material for Division V of this outline. Instructors should make sure that students thoroughly understand the significance of Food and Drug Administration regulations and that they appreciate the importance of abiding by these regulations.

New developments in technology to meet Food and Drug Administration requirements, as well as changing laws, policies, and practices of the government in relation to storage, Commodity Credit Corporation, transportation rates, and others, make it imperative that instructors keep the references and subject matter of this unit up-to-date.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Receiving	2	6
II. Grading at Country Elevators	2	6
III. Flow of Grain Through Country Elevator	4	6
IV. Storage	4	8
V. Grain Sanitation	4	8
VI. Safety in Grain Storage	1	2
VII. Fire Prevention	1	0
VIII. Warehouse Laws	1	2
IX. Operating Under the Uniform Grain Storage Agreement	2	2
X. Contracts with the Agriculture Stabilization and Conservation Service (ASCS) for Loading and Unloading Binsites	2	2
XI. Grain Bank Operations	2	4
XII. Merchandising Grain	3	4
XIII. Loading Trucks and Cars	2	4

XIV.	Methods of Selling	4	4
XV.	Hedging as a Tool for Country Elevators	3	0
XVI.	An Understanding of Grain Merchandising in Terminal Markets	3	0
XVII.	Transportation as Part of Grain Merchandising	3	2
XVIII.	Trading Rules for Grain Contracts	3	2
XIX.	National Arbitration Rules	2	2
	Total hours	48	64

Division I. Receiving

A. Unit of Instruction
  1. Weighing
    a. Proper weighing and care of the scales
    b. Prevention of theft
  2. Truck sampling
  3. Preparation of scale ticket
  4. Flow of truck traffic to prevent delay

B. Laboratory Projects
  1. Take a field trip to a local elevator or farm supply center where each student may:
    a. Weight a load of grain as it is received from the producer
    b. Prepare a scale ticket
    c. Sample the load of grain for determination of grade
  2. Make a sketch of the movement through the plant of trucks bringing grain into the country elevator. Locate the delaying factors in limiting the volume intake of grain. Prepare a report indicating what might be done to minimize delays.

Division II. Grading at Country Elevators

A. Unit of Instruction
  1. Moisture testing
  2. Dockage testing
  3. Other factors (Refer to the course *Grain Grading* for technique and for skill in determining grades.)

B. Laboratory Projects
  1. Using the samples obtained in laboratory project No. 1, Division I, run tests to determine grade of the grain.
  2. Prepare an itemized analysis showing how price of the grain can be determined. The analysis is determined from a basic price for a specific grade. It will show loss of weight due to moisture and dockage, cost of drying and cleaning, storage costs, margin required, and other factors to be considered.

Division III. Flow of Grain Through Country Elevator

A. Unit of Instruction
  1. Dump pits (kinds: gravity, conveyor, other)
  2. Elevator legs and/or conveyors
  3. Distributor
  4. Bins
  5. Scales
  6. Binning
  7. Loading cars or trucks
  8. Cleaning equipment
  9. Dryer

B. Laboratory Projects
  1. Take a field trip to visit one or more country elevators. Study and make notes on the kinds of equipment used in moving grain through the elevator.
  2. Prepare a flow chart showing the movement of grain through the elevator. Prepare an explanation of the operation of moving the grain; show how the equipment is used, how and where grain is stored, and how it is prepared for shipment to the market.

Division IV. Storage

A. Unit of Instruction
  1. Types of storage: flat, upright; advantages, disadvantages
  2. Storage facilities constructed of concrete, steel, wood, other
  3. Costs of storage
  4. Hot-spot detection
  5. Aeration
  6. Grain drying
  7. Conditioning grain by turning

B. Laboratory Projects
  1. Take a field trip to a nearby country elevator to observe a grain storage operation.

One or more field trips are recommended to observe the following:

- a. Upright storage and flat storage
- b. Devices for detecting hot spots in stored grain
- c. Aeration equipment and its operation
- d. Grain turning equipment and its operation

2. Compute the weight loss incurred by drying grain to a safe moisture percentage for storing. Use data secured from the local elevator or other data typical of the area. For example, if corn is received from the farm at 30 per cent moisture, what will be the loss in weight on 1,000 bushels of the farmer's corn when it is dried to 15.5 per cent moisture? Using data from laboratory project No. 2, Division II, recommend the percentage price cut of No. 2 yellow corn which should be paid the farmer for his corn.

Division V. Grain Sanitation

Check the course in *Grain Grading* for techniques of identifying many of the items of this unit. The purpose is to learn to recognize the importance of these in the grain handling, warehousing, and merchandising program.

A. Unit of Instruction

1. Preservatives
2. Fumigants
3. Checklists for grain sanitation
4. Rodent control
5. Bird control
6. Insect Control
7. FDA requirements and inspections

B. Laboratory Projects

1. Using current prices, compute the loss due to a decrease of one grade because of failure to maintain appropriate grain sanitation practices.
2. Take a field trip to a grain warehouse and record the practices used in maintaining appropriate grain sanitation. Upon returning to the laboratory, prepare a checklist to recommend for use in inspecting grain storage for sanitation practices.

Division VI. Safety in Grain Storage

A. Unit of Instruction

Instructors should avoid duplication of subject matter and student activities included in this unit and in the course *Physical Facilities and Care of Equipment*. Consider special safety hazards and practices particularly characteristic of grain handling and warehousing.

1. Safety practices to avoid injury to workers in relation to:
   - a. Using equipment
   - b. Good housekeeping
   - c. Environmental hazards
     - (1) adequate light
     - (2) fumes, chemical dusts, others
     - (3) ventilation
2. Safety practices to avoid damage to grain
   - a. Correct adjustment of equipment
   - b. Proper storage
   - c. Other practices (many included in other units of this course)
3. Color coding for safety
   - a. Identifying hazardous spots
   - b. Marking stairs, ladders, safety zones around machines
4. Safety practices in fumigation and in cleaning bins
   - a. Proper kind of mask
   - b. Proper equipment when working in bins
5. Safety practices in terms of appropriate clothing

B. Laboratory Projects

The available time for laboratory work may be combined with laboratory time dealing with safety available in *Physical Facilities and Care of Equipment*. Suggested laboratory projects include the following:

1. Demonstrations by experts on selection of cannisters for protection against specified materials when fumigating grain storage.
2. Demonstrations by experts on how to wear protective masks.
3. Preparation of charts and posters emphasizing safety practices in grain storage.
4. Demonstration or field trip to observe safety practices followed by employees working in grain bins.

Division VII. Fire Prevention

Unit of Instruction

1. Common causes of fires in grain storages
2. Electrical devices to avoid fires

    a. Magnetic switches in electrical lines
    b. Electric panels to identify motors that are running
    c. Warning signals such as bells and horns
    d. Automatic switches activated by heat, pressure, and humidity
  3. Use of fire fighting equipment in grain storage
    a. Sprinkler systems
    b. Fire extinguishers
    c. Water barrels
    d. Fire doors

Division VIII. Warehouse Laws

A. Unit of Instruction
  1. State warehouse laws
  2. U.S. Warehouse Act

B. Laboratory Projects

Secure voided copies of the warehouse receipt for grain form. Each student may be assigned a description of a load of grain for which he is to prepare a facsimile of a warehouse receipt.

Division IX. Operating Under the Uniform Grain Storage Agreement

A. Unit of Instruction
  1. Country Warehouseman's Contract with Commodity Credit Corporation
    a. General provisions
    b. Key sections of the Contract
      (1) purpose
      (2) basis on which grain is stored or handled
      (3) obligation to maintain stocks in warehouse
      (4) warehouse receipts and certificates
      (5) responsibility for condition of grain
      (6) loadout requirements
      (7) settlement for loadout
      (8) insurance
      (9) bonds, records, inspections, and reports
  2. Grain handled under the Uniform Grain Storage Agreement
    a. General provisions
    b. Warehouse-stored loan or purchase agreement grain
  3. Farm-stored loan or purchase agreement grain

B. Laboratory Projects

Secure copies of Form CCC Grain 50 Commodity Delivery Notice from the county Agriculture Stabilization and Conservation Service office. Complete the form for a specified lot of grain as if you were an employee of a local grain elevator company.

Division X. Contracts with ASCS for Loading and Unloading Binsites

A. Unit of Instruction
  1. Grain from CCC binsites
    a. Filling and emptying bins
    b. Moving through country warehouses
    c. Rejection of "actionable" cars
    d. Settlement for "actionable" cars

B. Laboratory Projects

Secure copies of the contract for loading and unloading binsites from the State ASCS offices. Complete the form for a specified lot of grain as if you were the manager of a local grain elevator.

Division XI. Grain Bank Operations

A. Unit of Instruction
  1. Advantages
  2. Disadvantages
  3. Operations

B. Laboratory Projects
  1. Take a field trip to a farm supply center that provides a grain bank service to its customers. Secure information on number of customers using the service, returns to the farm supply center for the service, cost of operating the service, and the advantages and disadvantages to the farm supply center for supplying the service.
  2. Assume you are employed by a farm supply center and assigned to make a study and recommendations regarding the introduction or continuation of a grain bank service. Also assume the same kind of data that were secured in laboratory project No. 1, or use data supplied by the instructor.

     Prepare a paper in which data and recommendations regarding the establishment or continuation of the grain bank are presented.

Division XII. Merchandising Grain

A. Unit of Instruction
   1. Following the markets
   2. Market discounts and premiums
   3. Purchasing grain from farmers and settlements

B. Laboratory Projects
   1. List the ways by which the manager of a country elevator is able to keep in touch with the market. The teacher assigns each student to one of the ways of keeping in touch with the market and investigates it thoroughly in terms of:
      a. Frequency of market reports during the day
      b. Scope of the reports—what factors that influence the market are reported?
      c. Significance of the reports

      Write an evaluation of this method of keeping abreast of the market
   2. After reports of all of the ways of keeping in touch with the market have been given, each student may outline his recommendations for a local manager to keep in touch with the market.
   3. Each student may prepare a chart for one or more kinds of grain, showing the amount of the discounts that are assessed and the factors causing the discounts. The chart should show the amount of premiums which are given and the factors which justify the premiums.

Division XIII. Loading Trucks and Cars

A. Unit of Instruction
   1. Preparation of bill of lading
   2. Inspection of cars to determine condition
   3. Preparation of cars for loading
   4. Loading of cars, including large covered hopper cars

B. Laboratory Projects
   1. Take a field trip to a local grain elevator where a car of grain is to be loaded. Inspect the car for condition and prepare the car for loading. Make sure there are no leaks in the car where grain may escape and that the condition of the car is such that the grain will not be damaged while in movement.
   2. Observe and report the method of loading and sealing the car. Describe the equipment used, the time and labor required, and the method of distribution of the grain in the car to assure uniformity throughout.
   3. Observe and report the method of loading trucks for hauling grain. Describe the equipment used, the time and labor required, and the method of distribution of grain in the truck to assure uniformity throughout.

Division XIV. Methods of Selling

A. Unit of Instruction
   1. Direct sales: truckers, farmers, processors, others
   2. To-arrive sales
   3. On track
   4. Through commission merchants

B. Laboratory Projects
   1. Assume you are employed by the manager of a local elevator and assigned to study and recommend the method of selling grain best suited to the operation. Make an analysis of the average prices and the range of prices that might have been realized during the past 3 years under different methods of selling. Calculate the costs involved in the different methods and the risks under the different methods. On the basis of the analysis, together with any supporting data from other sources, prepare recommendations for the manager. Illustrate the report with appropriate tables, graphs, and charts.
   2. The teacher appoints committees of students and assigns each committee one of the methods of selling grain. Each committee may prepare a skit to demonstrate how grain is sold under the method the committee is demonstrating.

Division XV. Hedging as a Tool for Country Elevators

Unit of Instruction
   1. Definition
   2. Purpose
   3. Hedging and speculation
   4. Cash and future price relationship
      a. Basis

    - b. Cash and future price in delivery month
    - c. Cash and future prices over time
    - d. Price relationship over space
    - e. The country basis
    - f. Factors affecting basis
  5. The mechanics of hedging
  6. Kinds of elevator hedge
    - a. Storage hedge
    - b. Coverage of cash sale ahead of harvest
    - c. Coverage of cash sale during marketing season
    - d. Hedges to defer pricing to farmers
  7. Basis patterns
  8. Tools of hedging
    - a. Price and basis data
    - b. Spread tables
    - c. Basis charts
    - d. Long and short records
  9. Space management program

Division XVI. An Understanding of Grain Merchandising in Terminal Markets

Unit of Instruction.

1. Cash grain sales at grain exchange
2. Terminal operations and merchandising

Division XVII. Transportation as Part of Grain Merchandising

A. Unit of Instruction
  1. Railroad grain freight rates
    - a. Accessorial charges
    - b. Transit
    - c. Demurrage
  2. Truck rates
  3. Barge rates

B. Laboratory Projects
  1. Compare the rates for transportation of grain by different methods available in the area.
  2. Use an outline map of the United States to trace the flow of grain from major production areas to the areas where it is utilized or exported. Examples might be:
    - a. Movement of wheat from the Dakotas to Great Lakes ports and the St. Lawrence Seaway
    - b. Movement of feed grains from Iowa and Illinois to the Southeast to feed livestock
    - c. Movement of wheat from Nebraska and Kansas to Gulf ports for export.

     In each of the cases prepare a statement to show how transportation rates influence the movement of grain.
  3. Prepare a step-by-step checklist showing the process of ordering transportation. List the steps in preparing and loading a car or truck—how it is directed to move, how it is consigned, how the grain is finally accepted by the purchaser, and how he pays for it.

Division XVIII. Trading Rules for Grain Contracts

A. Unit of Instruction
  1. Trade rules defined
    - a. Grain rules
    - b. Feed rules
  2. Importance of rules
    - a. Ethical basis of rules
    - b. Use of the rules to facilitate buying and selling of grain and feed
  3. Function of the Grain and Feed Dealers National Association in establishing, modernizing, and enforcing the trade rules.

B. Laboratory Projects

Students may be assigned in pairs: one member may represent a seller; the other, a buyer. Each seller may be assigned to sell a specified quantity of a grain or feed. The buyer may be assigned to buy the grain or feed. Each pair may then prepare a demonstration to show how the rules of the Association apply in the purchase of grain or feed. They may demonstrate the use of telephone and telegraph in the transaction, show how agreements are confirmed, and indicate the items to be included in the agreement.

Division XIX. National Arbitration Rules

A. Unit of Instruction
  1. Arbitration rules defined
  2. Function of the Association in establishing and maintaining the use of arbitration rules
  3. How arbitration rules are used

B. Laboratory Projects

Using the same assignment as in Division XVIII, each of the selected pair of students may select a point of disagreement in their transaction and demonstrate how the disagreement might be resolved using the Arbitration Rules of the Grain and Feed Dealers National Association.

TEXTS AND REFERENCES

Bonnett, *Hedging and the Banker.*

Chicago Board of Trade, *Corn Futures.*

———, *Grain Sorghum Futures.*

———, *Hedging Highlights.*

———, *Marketing Grain Through a Grain Exchange.*

———, *Oat Futures.*

———, *Rye Futures.*

———, *Soybean Futures.*

———, *Soybean Meal Futures.*

———, *Soybean Oil Futures.*

———, *Wheat Futures, Basic Facts and Sources.*

Eiland and Sorenson, *Economics of Grain Drying at Kansas Local Elevators.*

Grain and Feed Dealers National Association, *Arbitration Rules of the Grain and Feed Dealers National Association.*

———, *The Case of the Semi-Loaded Semis, a Case History of a Recent Grain Swindle.*

———, *Trade Rules of the Grain and Feed Dealers National Association.*

Herder, *Feed Grain Bank Operations in Kansas.*

Hieronymus, *Hedging for Country Elevators.*

New York Clearing House Association, *Warehouse Receipt Financing.*

Sampson Construction Company, Inc., *Grain Storage Through the Centuries.*

Schonberg, *The Grain Trade: How It Works.*

Slay and Hutchinson, *Receiving Rice from Farm Trucks at Commercial Dryers.*

Sogn, *Grain Merchandising at the Country Elevator.*

U.S. Department of Agriculture, *Suggested Guide for the Use of Insecticides To Control Insects Affecting Crops, Livestock and Household Pets.*

———, Commodity Credit Corporation, *Uniform Grain Storage Agreement.*

———, Economic Research Service, *Cost of Storing and Handling Grain in Commercial Elevators, 1964–65.*

———, Farmer Cooperative Service, *Economics of Flat Grain Storage Facilities in Kansas.*

U.S. Department of Health, Education, and Welfare; Food and Drug Administration, *General Principles of Food Sanitation.*

———, *Handling of Food Grains.*

VISUAL AIDS

Films

American Cyanamid Company, Agricultural Division, 6100 East 65th Street, Kansas City, Mo. 64133.

Protecting Our Grain Reserves. 16 mm., color, sound.

Millers National Federation, 309 West Jackson Boulevard, Chicago, Ill. 60606.

Wheat—Food for the World. 28 min., 16 mm., color, sound.

Operations I: Purchasing, Financial Control

HOURS REQUIRED

Class, 3; Laboratory, 2. Prerequisite: *Agricultural Economics and Marketing.*

COURSE DESCRIPTION

Operations I: Purchasing, Financial Control represents the first semester of a two-semester sequence. It is designed to acquaint the students with the application of principles to the operation of a local elevator and farm supply center. The first semester deals with a study of purchasing and the problems of determining margins, markup, and pricing that are associated with getting the goods ready for sale to the customers. Such problems as determining what to buy, identifying suppliers, determining terms, dating, and delivery agreements are included as part of the work on purchasing.

The study of controls in terms of operation of the business involves development of an understanding of the kinds of controls and how these can be used. The accounting system can provide information on which a number of controls can be based. Students should be given an opportunity to analyze data from accounting systems gathered from farm supply centers and to identify the items which can be used by managers and others for making decisions as to the operation of the business.

Laboratory sessions will give students an opportunity to prepare purchase orders, to analyze terms under which goods are purchased, to identify suppliers of merchandise associated with the farm supply business, and to plan the purchases for a typical farm service center for a period of 3 months to 1 year.

Computing ratios to measure efficiency of the business, planning methods of control of credit, and identifying and using other control methods will provide practical laboratory activities for the units on control of the business operation.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Purchasing Supplies, Margins, Markup, and Pricing	6	6
II. Purchasing and Selling Products from Farmers	4	0
III. Using the Accounting System	10	6
IV. Budgeting	10	8
V. Inventory Control	9	8
VI. Credit Control	9	4
Total hours	48	32

Division I. Purchasing Supplies, Margins, Markup, and Pricing

- A. Unit of Instruction
  - 1. Purchasing function
    - a. Establishing buying policies for the firm by determining:
      - (1) objectives of the firm
      - (2) sources of supply
      - (3) breath of offerings
      - (4) needs and wants of customers
      - (5) likely shifts in buying by customers
    - b. Determining goods customers want—quantity and quality
      - (1) record of past sales
      - (2) credit records
      - (3) suggestions of customers and suppliers
      - (4) trade papers
    - c. Determining quantity to purchase
      - (1) the period for which buying is done
      - (2) estimated sales
      - (3) present inventory
      - (4) inventory to be carried over
      - (5) preparation of a purchasing budget
    - d. Purchasing the goods
      - (1) sources of supply
        - (a) middlemen
        - (b) manufacturers
        - (c) growers
      - (2) terms of sale
        - (a) discounts
        - (b) datings
        - (c) other terms of sale
      - (3) the purchase order
        - (a) information needed on order form
        - (b) advantages of firm using own purchase order form

        - (c) advantage of using vendor's order form
        - (d) transfer of title
            - i. when title changes
            - ii. consignment buying
            - iii. returns of merchandise to vendor
    2. Margins
        - a. Definition
        - b. Computation
    3. Markup
        - a. Definition
        - b. Computation
        - c. Relation to margin
    4. Pricing merchandise—relationship of sales, prices, risk cost, costs of goods, markup, and expenses of operation to profits

B. Laboratory Projects

1. Each student may choose a product commonly sold in farm supply centers in the area. He should secure purchase order forms, terms of sale, delivery dates, bills of lading, and the like. These may be furnished by the instructor from a supply in the laboratory or may be secured by each student from the appropriate sources.

    The student should complete each of the forms for the product he has chosen. When alternative plans of payment are offered, an analysis of the advantages and disadvantages of the different plans are written by the student.

2. Take a field trip to a local elevator and farm supply center. Committees of class members may be assigned, or students may work individually, to prepare a list of the items sold at the center. Upon returning to the class, the lists may be combined to make a complete list of items sold.

3. Using catalogs and other literature, make a list of sources of the items.

4. Each student may select a group of related items such as fertilizers and fertilizer ingredients or others, and prepare a purchase order for his goods. He should indicate the terms, date for submitting the order, date he expects delivery, method of transportation and delivery, and the quantity of each item he orders. Emphasis should be placed on completeness, accuracy, and judgment displayed by the student regarding the decisions he has made.

5. A student may use a table to determine the markup based on cost necessary to provide a specified percentage margin. Using the items for which he has prepared purchase orders, he may estimate the margin as a per cent of selling price which the business will need. He will then compute markup over cost of the item to determine selling price.

Division II. Purchasing and Selling Products from Farmers

A. Unit of Instruction

1. Determining paying price
    - a. Market and price information
        - (1) sources of information
        - (2) using the information
    - b. Sampling and grading produce
        - (1) taking samples
        - (2) using results of tests and grades in pricing
    - c. Risk-bearing costs
        - (1) minimizing risk—hedging
        - (2) market fluctuations
        - (3) storage, handling costs
2. Selling the grain
    - a. Market channels
    - b. Transportation modes
    - c. Processing, blending
3. Financing the purchase and selling of grain
    - a. Use of seasonal credit
    - b. Relation to banks and bankers

B. Laboratory Projects

Students may select a product such as wheat which is grown in the community.

1. Describe the steps in receiving grain at the elevator and moving it into channels of trade. These steps should include sampling, grading, financing, and shifting risk.

2. Prepare an estimate of the amount of money the manager of the local elevator would need to have available to pay farmers for grain at harvest. Describe how money can be secured and what security will be required.

Division III. Using the Accounting System

- A. Unit of Instruction
  - 1. Financial analysis
    - a. Financial statements
      - (1) the balance sheet
        - (a) assets
        - (b) liabilities
        - (c) net worth
      - (2) the operating statement
        - (a) gross margin
        - (b) operating expenses
          - i. wages
          - ii. workmen's compensation
          - iii. electricity
          - iv. interest
          - v. maintenance and repairs
          - vi. telephone
          - vii. advertising and promotion
          - viii. depreciation
          - ix. insurance
          - x. taxes
    - b. Using financial ratio analysis to measure:
      - (1) liquidity
      - (2) efficiency
      - (3) profitability positions
    - c. Comparison with records from similar businesses
  - 2. Developing a financial control system
    - a. Essentials of a financial control system
      - (1) establishing profit centers
      - (2) establishing budgets for each profit center
        - (a) volume
        - (b) gross margin
        - (c) expense
        - (d) net income
      - (3) selecting most important control points
      - (4) establishing operating standards
      - (5) making use of management by exception principle
      - (6) facilitate flow of information
      - (7) aid in decision-making process
    - b. Developing needed materials
      - (1) departmentalized breakdown
        - (a) sales
        - (b) inventories
        - (c) cost of goods sold
        - (d) gross margins
      - (2) determining monthly and year-to-date comparisons to previous year and to budget
        - (a) operating statement
        - (b) balance sheet
        - (c) sheets showing summary of all data
        - (d) control charts or graphs
- B. Laboratory Projects
  - 1. Take a field trip to an elevator and farm supply center in the area. Observe the bookkeeping and accounting system in use in the business. Upon returning to the laboratory, prepare a report on the kinds of information which the accounting system could provide.
  - 2. As an alternative to the field trip, or an additional laboratory project, each student may be given the financial records of a farm supply center for the year. Use these records to compute each of the control items for the manager of the business and indicate recommendations for operating the business based on the analysis.
  - 3. Secure accounting data from a data processing system. Using these data, prepare an analysis of each of the control items recommended for the manager to consider in making adjustments in his business.

Division IV. Budgeting

- A. Unit of Instruction
  - 1. Importance, definition, and purpose of a budget
  - 2. Establishing goals for budgeting as based on:
    - a. Area potential
    - b. Previous experience
    - c. Anticipated expansion
    - d. Changing technology
  - 3. Preparation of a budget
    - a. What needs to be known
      - (1) cost-analysis data
      - (2) anticipation of future costs
    - b. Product mix
      - (1) deciding what products to carry
      - (2) relationship of costs and returns
    - c. Forecasting sales volume. (See unit on market survey in *Retail Farm Supply Merchandising*.)

B. Laboratory Projects

Secure complete annual financial statements and annual reports of a farm supply center business for at least 2 years. Using the data from these reports, prepare a complete budget for the coming year. In the budget, indicate for each department of the business at least the following items: total sales, total cost of goods sold, gross commodity profits, other income, total gross profits, total operating costs, and net operating proceeds. In addition, the budget should indicate unit volume of each item to be sold, estimated price, and expected total sales. In the same way, it should indicate estimated income from services. When these items have been prepared in detail for each department of the business, they may be consolidated to provide a budget for the total business.

Division V. Inventory Control

A. Unit of Instruction
  1. Keeping perpetual inventory on all major items
  2. Inventory turnover—factors contributing
     a. A well-developed merchandising plan
     b. A clean, well-lighted, attractive facility
     c. Limiting brands
     d. No duplicate inventory lines
     e. A definite plan for checking physical inventories against books
     f. Inventory stocks well balanced in relation to sales
     g. Mark down of "dead" items
  3. Reducing inventory shortage
     a. Plan for receiving merchandise
     b. Merchandise inventory used internally
     c. Avoiding pilferage, errors in or failure to bill merchandise, breakage, spoilage, shrinkage, obsolescence
     d. Accurate physical inventory
     e. Care in use of discounts
     f. Providing for accurate weights and measures
     g. Making regular physical inventory checks

B. Laboratory Projects
  1. Take a field trip to a local elevator and farm supply center, where arrangements have been made for the class to take a physical inventory. Divide the class into groups, and assign each group to make the inventory of a department of the business. If data are available, compare the physical inventory which the class has compiled with the perpetual inventory kept by the firm.
  2. The teacher divides the class into groups. He assigns each group to assume the role of a staff member in a farm service center to prepare recommendations as follows:
     a. Make written recommendations regarding ways to improve the inventory turnover and suggest margin as a per cent of selling price for items having different rates of turnover.
     b. Make written recommendations for a program to reduce inventory shortage in the farm supply center.

Division VI. Credit Control

A. Unit of Instruction
  1. Philosophy of credit as a sales tool
  2. Establishment of a policy for extending credit
  3. Evaluating credit risks
     a. Character references
     b. Net worth statements
     c. Credit bureau services
     d. Determining limitation of extension of credit
     e. Aging analysis of accounts
     f. Cost of credit
     g. Sources of agricultural credit for the patron
  4. Discounting accounts receivable
  5. Responsibility for the extension of credit

B. Laboratory Projects
  1. Take a field trip to a local credit bureau to determine the kinds of credit information available regarding customers in the area.
  2. Secure application-for-credit forms from a local bank, copies of a net worth statement (with identification removed), and reports from the credit bureau on the same individual. These may be collected and filed by the teacher for use by class members. The teacher organizes the class into committees of three to four to evaluate the credit of an applicant and to make a recommendation as they would to the

manager of a farm supply center if they were his employees.

3. Examine the accounts receivable of a local farm supply business, and prepare recommendations for the manager regarding each one. Prepare a written recommendation regarding a policy for handling credit accounts for the business.

   (*Note:* Records from business firms may often be secured for use by students, provided all identification is removed. This may necessitate not only removal of names but also modification of some of the items in the records.)

TEXTS AND REFERENCES

American Feed Manufacturers Association, *Management Guide: Livestock, Dairy, Poultry.*

Bailey, *Farm Supply Operations of Cooperative Grain Elevators in Texas.*

———, *Inventory Management by Selected Farm Supply Co-ops, Area 5.*

———, *Sound Credit Policy; Credit Control in Selected Retail Farm Supply Co-ops.*

Banshack, "Inventory Management," *Feed and Feeding Digest.*

Bradford and Scanlon, *Controlling Open Account Credit in Feed Cooperatives.*

Chapin and Hassett, *Credit and Collecting Principles and Practice.*

Credit Management Handbook.

Gabarins, *Operations, Practices and Costs of Selected Mixed Feeds.*

Gibson and Haynes, *Accounting in Small Business Decisions.*

Hall, *New Country Elevators; Influence of Size and Volume on Operating Costs.*

Kansas State University, *Planning Feed Handling Systems.*

Lasser, *How To Run a Small Business.*

Mather, *Handbook on Major Regional Cooperatives Handling Supplies.*

Mattison, "A Successful Tight Credit Policy," *Feed and Feeding Digest.*

Minneapolis Grain Exchange, *The Farmer Wants To Know About the Use of Credit for Production and Marketing.*

Phillips, *Feed Industry Financing and Contract Programs in Iowa and Surrounding States.*

———, *Managing for Greater Returns in the Grain, Feed and Other Retail Businesses Serving Agriculture.*

Richey and Johnson, *Factors To Be Considered in Locating, Planning and Operating Country Elevators.*

Smith and Gresham, *Budgeting for the Farm Supply Business.*

Smith and others, *The Farm Supply Industry.*

U.S. Department of Commerce, Bureau of the Census, *United States Census of Agriculture; Farms, Farm Characteristics, Farm Products.*

Yager, *Cooperative Country Elevators in Montana.*

FIGURE 28.—Technician class on field trip examines financial control records with manager.

Operations II: Functions of Management, Financing

HOURS REQUIRED

Class, 3; Laboratory, 2. Prerequisite: *Operations I; Purchasing, Financial Control.*

COURSE DESCRIPTION

The second semester of the course covers the functions of management and finance as applicable to the operation of a farm supply and elevator business. During this semester the student will develop an understanding of the relationship of management to the total business operation. The student will recognize that management is an essential part of the business organization and that many responsibilities should be delegated to the staff. This will require an understanding of the responsibility of key staff people for providing data and recommendations which can be used by the manager in reaching decisions.

Principles and alternative methods of reaching decisions, of communication between manager and staff, and between staff members are to be emphasized.

Field trips, resource persons from business and industry, and records and reports will help students gain experience during laboratory sessions in the preparation of materials for the manager.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Types of Business Organizations and Sources of Capital	20	12
II. Functions of Management	13	10
III. Depreciation of Buildings and Equipment	10	6
IV. Insurance	5	4
Total hours	48	32

Division I. Types of Business Organizations and Sources of Capital

A. Unit of Instruction
   1. Corporation, cooperative, partnership, individual ownership
      a. Organization
      b. Financing
         (1) raising money through sales of stock
            (a) common
            (b) preferred
         (2) raising money through issuing bonds
            (a) kinds of bonds
            (b) costs of money raised by sales of bonds
         (3) raising money by borrowing from banks
      c. Who assumes the risk and receives the profits
      d. Who owns the business
      e. Who can vote in the organization

B. Laboratory Projects
   1. Take field trips to visit two or more of the major types of business organization. Prepare a written report describing the types of business organizations found in the United States. On the basis of the information you receive from the field trips and the study and observation, explain how each type of organization might raise money for capital improvement.
   2. Prepare a chart, flannel graph, or other visual to show the organization of a corporation and/or a cooperative. Indicate lines of authority and responsibility in the chart.
   3. Bring in the financial page of a newspaper or other source and identify names of companies having:
      a. Preferred stocks listed
      b. Common stocks listed.
      c. Bonds listed

      For the common stock, the preferred stock, and the bonds answer the following questions:
      a. What assets are available to pay in each case?
      b. What returns are made on each?
      c. In case of liquidation of the business, indicate the order in which the three liabilities are normally paid.

      For the point of view of the business, what are the advantages and disadvantages of each of the three methods of raising money for capital improvement? What governmental controls are placed on raising capital by issuing stocks or bonds?

4. (*Note:* Review Division III, ***Operations I: Purchasing, Financial Control,*** "Use of the Accounting System," as preparation for the activities suggested in the following laboratory project.)

   Invite a banker to visit the class to describe the way in which a farm supply center borrows from a bank for capital improvement. Ask him to compare borrowing from the bank with raising money by sale of bonds or stocks.

   Prepare a recommendation for the board of directors of a farm supply center for raising money for a particular capital improvement. Show estimates of cost of the investment and the returns to be realized.

Division II. Functions of Management

A. Unit of Instruction
   1. Planning
      a. What products and services to provide
      b. What combination of resources to use
      c. Capital requirements
      d. Labor requirements
      e. Facilities needed
      f. Policy for the business
   2. Organizing the business by:
      a. Departments
      b. Determining the kind and number of jobs
      c. Determining the organizational structure
      d. Writing job descriptions
      e. Measuring performance
   3. Personnel practices and procedures
      a. Applications for positions
      b. Hiring practices
      c. Discipline among employees
   4. Directing the business
      a. Delegating responsibility and authority
      b. Using specialists
         (1) consultants
         (2) college people
         (3) supply people
         (4) trade associations
      c. Giving directions
   5. Coordinating
      a. Communication, formal (See ***Communications I*** and ***Communications II*** on how to prepare communication devices. Here emphasis is on what devices to use.)
         (1) letters
         (2) oral
         (3) public address system
         (4) intercom system
         (5) bulletin board
      b. Communication as it affects discipline, loyalty, and cooperation
   6. Control
      a. Major areas to be controlled
      b. Setting goals and standards
      c. Identifying trouble spots
      d. Determining solutions to problems
      e. Taking timely action
   7. The role of the manager
      a. Providing dynamic leadership
         (1) to the staff
         (2) in the community
      b. Building an image of the firm and the industry
         (1) ethics and trade standards
         (2) honesty in business transactions
         (3) contribution to the community

B. Laboratory Projects
   1. Prepare a presentation to the manager showing estimates of additional capital, labor, and facilities needed to add a service or related item for the public. Use records of sales by departments or inventory turnover or both to support the need for the additional service or item. Present facts the manager would need to help reach a sound decision.
   2. Prepare an adequate organization chart for a farm supply center to serve a community in the State. Identify each kind of job in the organization and prepare a job description. Indicate whether jobs are seasonal or permanent.
   3. Prepare recommendations for the manager indicating lines of communications within the organization, making sure that all individuals are kept properly informed.
   4. Assume you are employed by a farm service center as a key employee. Outline the

personnel policies for the manager to follow in dealing with the employees in the plant. Prepare a report to be submitted to the manager in which these policies are outlined. Describe the procedure for explaining such policies to the employees.

5. Students may be assigned to committees of two or three. The committees may assume that they represent employees of a farm supply center. Each may be assigned a specific aspect of personnel management and may discuss the problem in line with policies as suggested in laboratory project No. 4. A report of the committee recommendations may be prepared and presented. As an alternative, if time permits, each committee may present an oral report before the class.

Division III. Depreciation of Buildings and Equipment

A. Unit of Instruction
  1. Determination of depreciation rates
    a. Straight-line depreciation
    b. Sum of digits
    c. Declining balance
    d. State and Federal laws—depreciation requirements
  2. Providing for obsolescence

B. Laboratory Projects
  1. Make an inventory of the buildings and equipment in a local farm supply center or country elevator business.
    a. Determine the approximate cost of each item on the list and estimate the life of each item.
    b. Establish a method of depreciation and a rate of depreciation for each item on the list.
    c. Prepare a table showing annual depreciation for each item on the list. This may be presented in the form of a chart.
  2. Invite a manager of a farm service center in the area or an expert on depreciation to visit the class as a consultant on depreciation schedules.

Division IV. Insurance

A. Unit of Instruction
  1. Fire and explosion
  2. Health and accident
  3. Liability
  4. Business interruption
  5. Tornado or flood
  6. Product liability
  7. Workmen's compensation

B. Laboratory Projects
  1. Using the organization chart prepared in a previous project, make a list of the types of insurances that should be carried to protect the firm from disasters such as fire, flood, business interruption or other losses.
  2. Assume you are employed in a local grain, feed, seed, or farm supply business. Prepare a list of insurances for the manager stating the amount of protection to be carried, the cost of the insurance, and the major provisions of the recommended policies. (*Note:* The assumptions made regarding the business will need to be stated. These may be developed by the student or furnished by the instructor.)

TEXTS AND REFERENCES

Anthony, *Management Accounting: Principles.*

Bierman, *Financial and Managerial Accounting, an Introduction.*

Bohnsack, "Key Indicators and Cost Analysis for Elevator and Farm Supply Businesses."

Bonneville, *Organizing and Financing Business.*

Bradford and Scanlon, *Controlling Open Account Credit in Feed Cooperatives.*

Corbin, *Accounting and Economic Decisions.*

Credit Management Handbook.

Dale, *Managerial Accounting in the Small Company.*

Easton and Newton, *Accounting and the Analysis of Financial Data.*

Ettinger and Golieb, *Credits and Collections.*

Gibson and Haynes, *Accounting in Small Business Decisions.*

Johnson, *Financial Management.*

Lewis, *Accounting Reports for Management.*

———, *Financial Analysis for Management.*

Manuel, *Improving Management of Farmer Cooperatives.*

Prather, *Financing Business Firms.*

Preston, *Managing the Small Independent Business.*

Purdue University, Agricultural Experiment Station, *A Financial and Business Analysis of Indiana Grain Elevators.*

Stolte, "College Researchers Offer Valuable Management Tips," *Feed and Feeding Digest.*

Trock, *Costs of Grain Elevator Operation in the Spring Wheat Area.*

Wilson and Smith, *Managing the Farm Supply Business; Ten Areas.*

Physical Facilities and Care of Equipment

HOURS REQUIRED

Class, 1; Laboratory, 8. Prerequisite: *Operations I: Purchasing, Financial Control.*

COURSE DESCRIPTION

The course is designed to give students practice in planning the layout of buildings, driveways, and facilities on a site. It is designed to plan the flow of materials in a plant and the safe operation of a plant and equipment, in terms of workers, customers, buildings, products, and equipment.

Maintenance of equipment and buildings, proper adjustment of equipment, and use of manuals for specific machines are included as laboratory activities in the program.

It is important for students in this course to gain a concept of the overall operation of a plant in terms of the efficient use of equipment and labor. An appreciation of the relation of efficient operation to the profits of the firm should be developed. Students are to be encouraged to look ahead to the next 15 to 25 years to visualize changes they would recommend as remodeling is done or as present buildings and major pieces of equipment are replaced. Using a local situation will give students a concrete problem on which to work. The instructor and school administrators need to have a clear understanding with the manager about the work their students will be allowed to do.

When field trips are to be made in the evening while the plant is closed to the public, it will be essential that all fire prevention rules be strictly enforced. It will be necessary to have a member of the staff from the local plant present to help with the instruction and to make sure equipment is properly adjusted for the next day's operation.

A study of the buildings, equipment, and arrangement of machinery in the buildings is essential for students who wish to study the flow of materials and the problems of maintenance from a practical point of view. Students should study the situation from an objective point of view rather than criticize the present facilities in the community.

Responses from a large number of consultants in the grain and feed industry indicate that technicians would not be expected to possess shop skills for the repair of equipment. It is important, however, for these employees to understand problems of maintenance and adjustment of equipment, and safety in its operation.

The laboratory sessions in this course should be devoted largely to a study of the flow of materials, the proper layout of equipment in the buildings, the most desirable arrangement of buildings on the site, and the use of the manuals for the adjustment of individual machines. The work may be conducted in the school laboratories and facilities for grain and feed operations and for seed processing.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. General Layout of Country Elevators, Feed Mills, and Farm Supply Facilities	2	20
II. Kinds of Equipment Commonly Found in Country Elevators, Feed Mills, Seed and Farm Supply Stores	4	22
III. Maintenance of Equipment	2	24
IV. Maintenance of Storage Facilities	2	22
V. Maintenance of Buildings	2	22
VI. Efficient Use of Equipment	4	18
Total hours	16	128

Division I. General Layout of Country Elevators, Feed Mills, and Farm Supply Facilities

A. Unit of Instruction
  1. Elevator
  2. Grain storage bins
  3. Feed mills
  4. Farm store and office
  5. Fertilizer storage and loading facilities
  6. Location of other facilities such as fencing, lumber, petroleum
  7. Driveways
  8. Location of firefighting facilities
  9. Location of facilities in relation to railroad, siding, and main highways

B. Laboratory Projects
   1. Visit a farm supply center, and work in pairs to get dimensions of buildings, distances between buildings, and widths of driveways. Make a sketch of the layout of the facilities showing location of each building in relation to railroads, highways, firefighting facilities, and other services.
   2. Review the references dealing with layout of farm supply centers. Prepare a sketch of a layout as one would have it if it could be rebuilt at the present time.
   3. Trace the movement of trucks delivering grain from farmers to the elevator, the movement of trucks and cars of customers purchasing supplies, and the movement of trucks delivering goods to the farm supply center. Locate and list factors limiting efficient operation.
   4. Prepare a chart showing where to locate firefighting equipment in the layout visited by the class. Locate the kind of firefighting equipment at each point. Show the route for fire department apparatus on the grounds and the location of fire hydrants available. Points of access to buildings must be considered both in basements and in elevated areas.
   5. Plan a layout of a farm supply store and office to provide for the kind of business you envision during the next 15 to 25 years in the area. In the sketch, provide for offices for the manager and other staff members, for the clerical staff, for displays and sales room, for a laboratory (if it should be located in the farm supply store building), and for other facilities which will be needed. Chart the anticipated flow of traffic. Plan the layout for maximum efficiency and convenience.

Division II. Kinds of Equipment Commonly Found in Country Elevators, Feed Mills, Seed and Farm Supply Stores

A. Unit of Instruction
   1. Grain and seed handling and processing equipment
      a. Dump pit
      b. Elevator leg and conveyors
      c. Aeration
      d. Drying
      e. Grain grading (screens, scales, other)
      f. Moisture testing
      g. Seed cleaning
      h. Seed packaging
      i. Seed treating
      j. Blending
   2. Feed processing equipment
      a. Grinders
      b. Mixers
      c. Pelleting machines
      d. Conveyors
      e. Bins
      f. Packaging equipment
   3. Materials handling equipment
      a. Lift trucks
      b. Delivery trucks
      c. Conveyor
      d. Loading and unloading equipment
   4. Weighing equipment
      a. Truck scales
      b. Package scales
      c. Weight-per-bushel scales
      d. Laboratory scales
   5. Equipment relationships to:
      a. Horsepower requirements
      b. Speed and pulley size
      c. Leg speeds and capacity
      d. Electricity, wire-size, and load
      e. Bin size
      f. Building materials, cost, insurance, and maintenance

B. Laboratory Projects
   1. Take a field trip to a nearby elevator and feed mill to discover the kinds of equipment located in various buildings making up the center. If possible, each student should make a complete inventory. If it is more feasible, students may be assigned in groups to inventory the feed mill department equipment, the grain elevator department equipment, the fertilizer department equipment, and others. Capacity of each piece of equipment should be noted.
   2. Upon returning to the laboratory, each student may be supplied with a complete inventory of equipment at the plant. Students may then be assigned many different kinds of problems. Suggested sample problems include:

   - a. Compute the bushels of grain per hour that can be elevated to bins with the elevator facilities at the plant.
   - b. Compute the speed of the elevator with the present motor and pulley sizes on the equipment.
   - c. Compute the capacity of the grain storage bins in the plant.
   - d. Determine the quantity of feed grains and supplement that might be processed per 8-hour day with the present feed mill equipment.
   - e. Estimate the bushels of grain that need to be dried per day at harvest time and check this against the capacity of driers in the plants.
   - f. Identify bottlenecks in the process of buying and processing grain and of processing feeds. What investment would be required to eliminate the bottlenecks?

3. Check the fire insurance rates for similar buildings built of wood, steel, and concrete. Using these rates, secure an estimate of the cost of construction of each kind of building and its estimated life. Compute which building would be most economical to build today. Compare insurance costs versus the necessary investment based on type of building construction.

Division III. Maintenance of Equipment

A. Unit of Instruction

1. Safety practices and operation of equipment to prevent:
   - a. Injury to workers
   - b. Damage to product
   - c. Damage to equipment
   - d. Damage to the plant
   - e. Fire and accidents
     - (1) eliminating fire hazards
       - (a) dust control, avoiding dust explosions
       - (b) avoiding overheated motors and slipping belts
       - (c) avoiding electrical sparks
       - (d) prohibiting smoking
       - (e) using safety shields on lamps
       - (f) avoiding welding dangers
       - (g) investigating and studying methods to control "spread of fire" through the building, conveyors, and spouting
     - (2) housekeeping to avoid accidents
     - (3) safe practices with chemicals
       - (a) use of masks
       - (b) avoiding contamination of grain, feed, and seeds
     - (4) safe practices with delivery trucks
     - (5) safe practices with machinery used in custom operations
     - (6) safe practices with electrical equipment, switches, fuses, and controls
     - (7) safety checks
       - (a) maintaining and periodically checking all safety equipment
       - (b) cleanliness of buildings and equipment to avoid fires and explosions
       - (c) checking heating, ventilation, and air conditioning equipment
       - (d) organizing and carrying out safety campaigns
       - (e) safety coding
       - (f) training employees in what to do in case of fire or accident
2. Adjustment of equipment
   - a. Use of the manual
   - b. Making adjustments
   - c. Kinds and uses of controls
     - (1) automatic
     - (2) manual
3. Servicing the equipment
   - a. Use of the manual
   - b. Lubrication
   - c. Controls: electrical, hydraulic, manual
   - d. Methods of cleaning equipment

B. Laboratory Projects

1. Take a field trip to a country elevator or a feed mill in which the most up-to-date safety devices are used and where the safety practices of the personnel are the best that can be found. Students may be assigned to the role of safety specialist for the firm. They may then inspect the

plant, making note of all the safety devices they can discover.

2. Upon returning to the classroom each student may describe the safety devices he has discovered and explain the kind of hazard against which they protect. For purposes of reporting, students may include devices to protect against such hazards as those caused by electricity, lift trucks, delivery trucks, grain and feed processing and handling equipment.

   As an alternative they may report on devices to combat hazards of injury to workers, fire hazards, hazards to products, and equipment hazards.

3. Take a field trip to a grain elevator, feed mill, or fertilizer plant (preferably during the hours the plant is not open for commercial business). Make adjustments on one or more of the machines in the plant.

   (*Note:* While practice on the adjustment of machines may be given in the laboratory, the practice on machines in the plant will be a valuable experience. If facilities are available, this field trip may be repeated several times to give students an opportunity to work on a number of different machines.)

4. Invite a representative of a local fire department to describe the types of fire extinguishers and where they might be used in the elevator and feed mill. Have him demonstrate the effectiveness of each kind on the types of fires for which each is suitable. For example, shallow pans of oil may be ignited and the fire extinguished with appropriate extinguishers to demonstrate relative effectiveness. The fireman may also demonstrate the method of checking each kind of fire extinguisher for proper working order.

   Each student may assume that he is employed by the manager of the local farm supply center. One of his duties is to serve as the plant safety inspector. Each student may prepare a report he would make to the manager with his recommendations for the kinds and locations of fire extinguishers for the plant.

Division IV. Maintenance of Storage Facilities

A. Unit of Instruction
   1. Cleaning storage facilities
   2. Applicators for treating by:
      a. Fumigating
      b. Dusting
      c. Spraying

B. Laboratory Projects
   1. Students may take a field trip where they may observe a demonstration of the proper safeguards for cleaning one or more storage buildings. The teacher should emphasize the necessities for thorough work, for accuracy in the use of cleaning and fumigating materials, and for proper protection when using chemicals.
   2. Make a list of fumigants and sprays used to clean bins in the local grain storage facilities. Include residue tolerance of the Food and Drug Administration and omit any fumigants not approved by grain insurance companies.
   3. If possible, take a field trip to a local elevator where a demonstration of lowering a man into a grain bin can be given. The teacher should emphasize the observation of all safety precautions.

Division V. Maintenance of Buildings

A. Unit of Instruction
   1. Concrete buildings
   2. Sizes and specifications of joists and beams for loads to be carried
   3. Wood preservation
   4. Materials handling

B. Laboratory Projects
   1. Draw the floor plan for one of the buildings at the local elevator, feed mill, or farm supply center showing the dimensions and locations of various areas, machines, electrical outlets, sprinkler system pipes, plumbing equipment, and conveyor tubes.
   2. Using the sketch, indicate the points at which maintenance problems are likely to appear, the nature of the problems, and the suggested remedies.
   3. Sources and kinds of materials for doing the anticipated maintenance work should

be accumulated. So far as possible, the effectiveness of items should be tested in the laboratory.

Division VI. Efficient Use of Equipment

- A. Unit of Instruction
  - 1. Effect of hours of use per day
  - 2. Records to be kept on equipment
    - a. Hours of use per day
    - b. Volume of work done
    - c. Cost of operation
    - d. Cost of repairs
      - (1) parts
      - (2) labor
      - (3) lost time
    - e. Inventory of equipment
  - 3. Requisitioning and inventorying parts and supplies
- B. Laboratory Projects
  - 1. Use the inventory of equipment secured early in the course. Check catalogs and determine the cost (new) of each machine on the inventory. Annual depreciation may be estimated for each machine and depreciation cost per hour may be determined for various estimated hours per day of use. What is the cost to a firm of a breakdown of a machine? What is the loss from idleness of other machines and labor due to the breakdown of one machine?
  - 2. Prepare a written report with recommendations for minimizing idle time of machines and labor.
  - 3. Assume the role of a man in charge of maintenance at a local elevator, feed mill, or farm supply center. As a final laboratory project for the course write a complete plan with recommendations for the maintenance of the plant including safety, efficient layout and operation, and customer convenience and service.

TEXTS AND REFERENCES

Anderson and Alcock, *Storage of Cereal Grains and Their Products.*

Bouland and Smith, *A Small Country Elevator for Merchandising Grain.*

Bruce and others, *Planning Grain Elevators for the Southeast.*

Consolidated Catalogs and Engineering Bluebook.

Cotton, *Pests of Stored Grain and Grain Products.*

Hall, *Processing Equipment for Agricultural Products.*

Kline and Converse, *Operating Grain Aeration Systems in Hard Winter Wheat Area.*

Michigan Millers Mutual Insurance Company, *Fire Prevention in Grain Plants.*

Mill Mutual Fire Prevention Bureau, *Employee's Fire Prevention Manual; Fire Prevention-Protection Programs for Grain and Milling Properties.*

———, *Spontaneous Heating in Feeds, Grains and Hay.*

Pfister and Clark, *Farm Fire Safety.*

Stevens and Schoeff, *Prevention of Fire and Dust Explosions in Feed Mills, Flour Mills, and Grain Elevators.*

U.S. Department of Agriculture, Agricultural Marketing Service, *Method and Equipment for Bulk Treatment of Grain Against Insects.*

VISUAL AIDS

Films

Aetna Life Affiliated Companies, 151 Farmington Avenue, Hartford, Conn. 06115.

Lifting, Man's Age Old Problem. 14 min., 16 mm., color, sound.

Stop Them Before They Start. 14½ min., 16 mm., color, sound.

Association of Mill and Elevator Mutual Insurance Companies, 2 Riverside Plaza, Chicago, Ill, 60606.

Before Your Mill or Elevator Burns. 20 min., 16 mm., color, sound.

Fire Fighting in Country Elevators. 20 min., 16 mm., color, sound.

National Board of Fire Underwriters, 85 John Street., New York, N.Y. 10038.

Above and Beyond. 12 min., 16 mm., black and white, sound.

Are You Sure? 14½ min., 16 mm., color, sound.

University of Minnesota, Audio-Visual Service, Minneapolis, Minn. 55101.

Slip Form Construction of Concrete Grain Elevators. 28 min., 16 mm., color, sound.

Retail Farm Supply Merchandising

HOURS REQUIRED

Class, 3; Laboratory, 4. Prerequisite: *Communications II: Oral, Illustrated;* and *Agricultural Economics and Marketing.*

COURSE DESCRIPTION

This course is designed to prepare students to merchandise supplies commonly distributed through farm supply centers. The content of the course includes practical aspects of merchandising except salesmanship, which is covered in a course offered in the fourth semester. *Retail Farm Supply Merchandising* should be prerequisite to *Salesmanship.*

The major emphasis in the course is on making a market survey, building an advertising calendar, preparing an advertising budget, writing advertisements, designing displays, and planning and carrying out promotion days.

After the market survey has been completed, the students may act as farm supply center staff members planning an advertising calendar for the year. It is suggested that the calendar indicate two or more items commonly sold each month by a local farm supply center. Each student may select one of these items (preferably not more than two students choosing items for any one month) and use it in his project during the remainder of the semester.

In succeeding laboratory sessions he will plan and prepare the advertising, build the displays, and plan the total promotion of his item of merchandise. At the same time, he will have an opportunity to observe and discuss the presentations of each of the other members of the class. Preparing the advertising and displays requires that the student determine what media he will use. He will investigate costs of different advertising media, prepare all of the materials, and present them for the criticism of the class. Assign each student a space in the laboratory which he may use throughout the semester to build a display. Suitable materials should be used for building and decorating the display. In addition, it is assumed that many appropriate products of farm supply centers in the area may be featured in the advertising and in displays prepared by the students.

Invite resource persons in advertising and display to discuss and demonstrate principles of promotion of products.

Near the close of the semester, a "promotion" day may be planned by the class for which businessmen of the area could be invited to see the displays and other projects and to offer their comments and evaluation of the projects.

As a final step in the course and to provide orientation for the course entitled *Salesmanship,* each student may prepare and demonstrate a sales presentation for his product. Record the presentation so that it can be used for comparison during the salesmanship course.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Making a Market Survey	9	14
II. Building an Advertising Calendar	9	4
III. Building an Advertising Budget	9	4
IV. Writing Advertisements	9	18
V. Preparing Displays	9	18
VI. Planning Promotion Days	3	6
Total hours	48	64

Division I. Making a Market Survey

A. Unit of Instruction
  1. Defining the trade area
  2. Determining the sales potential
    a. Numbers of livestock
    b. Acres of each crop grown
    c. Production of each class of livestock and crop
    d. Past years' consumption of feed, fertilizers, and chemicals in the territory
    e. Estimated changes next year, next 5 years
  3. Analyzing the competition
    a. Services provided
    b. Prices
    c. Products
    d. Programs offered
    e. Leadership

4. Determining customer needs
    a. Type of farming
    b. Trends in production
    c. Purchasing habits
    d. Product and service demands
5. Developing a program to provide:
    a. Products customers want
    b. Services customers demand

B. Laboratory Projects

1. Identify a trade area. Several alternative projects may be used:
    a. Students may secure information from the manager of the local farm supply center which may be used to identify the trade area of the local business.
    b. Each individual student may interview different managers of farm supply centers in a portion of the State.
    c. The students might identify a hypothetical farm supply trade area with the school as a center. The trade area should be clearly identified on a grid map of the locality.
2. Students may use census data and other sources of information to determine the potential volume and kind of supplies to be used in the territory. Each student may carry through the complete analysis, or students may be assigned to analyze a portion of the total potential.

Division II. Building an Advertising Calendar

A. Unit of Instruction

1. Products to emphasize each month
    a. Seasonal demand for farm production supplies
    b. Point of purchase display plans
2. Inventories to be moved
    a. To make more efficient use of space
    b. To avoid obsolescence
3. Days of the week to feature certain items
    a. Store traffic
    b. Buying habits of customers in the store and on the farm
    c. Timing advertisement to attract most people
4. Featuring complementary items
    a. Name-brand promotions with tie-ins
    b. Combinations in which one item suggests another
5. Key farm income periods

B. Laboratory Projects

Construct an advertising calendar. Use the data from the market survey and prepare a list of two or three farm supply items to be featured each month. This may be done by the class assuming the role of the staff members in a farm supply center. When the calendar is completed each student may select the product he will merchandise. The teacher schedules the merchandising program for each month so that no two students are assigned the same product.

Division III. Preparing an Advertising Budget

A. Unit of Instruction

1. Selecting advertising media
    a. Kinds of media
        (1) newspaper, display, classified
        (2) magazine
        (3) program announcements
        (4) direct mail; letters, cards, package inserts, leaflets
        (5) radio
        (6) television
        (7) outdoor posters, painted signs, electric signs, signs on billboards and trucks
        (8) car cards
        (9) handbills
        (10) shopping news
        (11) inside posters
    b. Cost of each kind of media
2. Steps in building the budget
    a. Deciding amount to be allocated for advertising
    b. Using data from previous year to determine:
        (1) distribution of sales by month
        (2) cost of advertising in each medium by department
    c. Developing program for promotion of goods and services
    d. Distributing amounts
        (1) to each medium to be used
        (2) to season of the year

B. Laboratory Projects

Prepare an advertising budget. Each student should develop a budget for advertising his product. It should indicate the money to be spent for different kinds of advertising. Include the displays to be built and the advertising to be prepared. The teacher gives students a summary of the previous years' record of sales by departments and other data, or makes estimates on which to base budgets. Compile a summary of individual budgets to represent the total merchandising budget for the year.

Division IV. Writing the Advertisements

A. Unit of Instruction
1. The advertisement should:
    a. Attract attention
    b. Arouse interest
    c. Create desire
    d. Result in action
2. Developing the advertisement
    a. The headline: attracting attention, arousing interest
    b. The illustration: providing product information, creating desire
    c. The copy: providing product information, creating desire, inducing action.
    d. The layout: arrangement, size, spacing
    e. Store name, address, phone, and hours
3. Cooperative advertising: its uses, advantages, disadvantages
4. Regulations of the Federal Trade Commission

B. Laboratory Projects
1. Make a collection of advertisements from farm papers, magazines, newspapers, handbills, and other sources. Prepare a score card for evaluating the advertisements and rate each advertisement. Identify the strong points of the advertisement.
2. Plan an advertising program in terms of individual budgets. The cost of each type of advertising media should be determined. This plan should be written up for review by other students and the instructor. Prepare advertisements to include design, message, pictures, and illustrations, as well as other specifications. Specify the time the advertisement will run, its size, and where it will be used.
3. Secure the advertising material for the product from the manufacturer. Plan an advertisement for the local newspaper.

Division V. Preparing Displays

A. Unit of Instruction
1. Principles of display
2. Materials for display
    a. Background materials
    b. Actual objects
    c. Lights
    d. Motions
    e. Specimens
    f. Posters and pictures
    g. Live objects: plants, animals, chicks, etc.
3. Making displays
4. Exhibits at fairs and community events

B. Laboratory Projects
1. Visit a series of store windows, displays at a fair, or at other places where displays are available. Make notes regarding each display. Indicate attractive features, what methods are used to attract attention and to develop interest, what materials are used, and what merchandise is featured. Evaluate each exhibit in terms of the application of the principles of display.
2. Students may work individually or in pairs to visit display artists for retail businesses. Each student should get all of the information possible regarding the steps followed in planning and making a display. Such information as the following will be important to the students for use in later projects.
    a. Sources and kinds of materials for building displays—backgrounds, turntables, lights, and stands
    b. Sources of ideas regarding arrangement of materials, color, lights, and other factors
    c. Best use of space
    d. When and what to display
3. Observe an artist setting up a display in the store window or on the floor of a retail store. Invite him to the school laboratory to demonstrate setting up a display using materials sold by a local farm supply center.
4. Each student should prepare a display of his product in the laboratory. He should be encouraged to use materials furnished by companies and those prepared by him. While the student has been assigned to merchandise one product, he should be

encouraged to include related products in the display where these are appropriate. The displays may be evaluated by representatives of the industry or by advertising specialists at an open house or promotion day near the close of the semester.

Division VI. Planning Promotion Days

A. Unit of Instruction
  1. Purpose of promotion days
  2. Time of year to put on a promotion day
  3. Program to present
  4. Committees of staff to appoint

B. Laboratory Projects
  1. Plan a promotion day similar to the "appreciation days" commonly used by local farm supply centers. The class members may assume the role of a staff member of a farm supply center to plan and carry out the program. Representatives of the grain, feed, seed, and farm supply industry in the area may be invited, as well as the faculty of the school, to review the work of the class. The displays may be evaluated by professional display artists.
  2. As a means of relating the *Retail Farm Supply Merchandising* course with *Salesmanship,* each student may prepare a sales presentation of his product. This may be presented before the class. Tape recordings of each presentation will be useful for study by the students in *Salesmanship.*

TEXTS AND REFERENCES

DeJen, *Visual Presentation Handbook for Business and Industry.*

Frye, Boyd, and Westfall, *Advertising Proceedings and Practices of Agricultural Commodity Groups*

Garrett, *Ethics in Business.*

Grain and Feed Dealers National Association, "Guideposts for Successful Retail Advertising," *Feed and Feeding Digest.*

Hotchkiss, *An Outline of Advertising.*

Phillips, *Managing for Greater Returns in the Grain, Feed, and Other Retail Businesses Serving Agriculture.*

Phillips and Duncan, *Retailing Principles and Methods.*

Reich, Feldman, and Levy, *Basic Retailing.*

U.S. Department of Commerce, Bureau of the Census, *United States Census of Agriculture; Farms, Farm Characteristics, Farm Products.*

Van Riper, *Words at Work in Advertising.*

Walters, Snider, and Sweet, *Readings in Marketing.*

Wingate and Schaller, *Techniques of Retail Merchandising.*

Young, *Techniques of Advertising Layout.*

VISUAL AIDS

Filmstrips and Slides

Chevron Chemical Company, 200 Bush Street, San Francisco, Calif. 94120.

Merchandising Fertilizer as a Service to Farmers. Twenty-seven 2 x 2 slides, color, mimeographed script.

University of California, Audio-Visual Center, Berkeley, Calif. 94720.

Planning Your Exhibit. One-hundred-six 2 x 2 slides, color.

Premium Meal
DOG FOOD

FIGURE 29.—Farm supply center technicians also serve urban and suburban dwellers.

Seed Production, Preparation, and Analysis

HOURS REQUIRED

Class, 1; Laboratory, 6. Prerequisite: *Crop Production.*

COURSE DESCRIPTION

Many kinds of seeds are produced throughout the United States. Their importance for successful crop production cannot be overemphasized. This course is designed to provide the necessary training to prepare technicians to test, grade, treat, and label seeds in conformity with State and Federal regulations for labeling.

The use and adjustment of seed cleaning machinery and the cleaning of machinery to avoid contamination are important parts of the course. Also included are methods of cleaning seeds to bring them to desired standards of quality.

The technician employed in a farm service center will be called upon for advice by seed producers. The course provides experience in the inspection of fields for seed certification and in the testing and analysis of seeds for certification.

This course aims to prepare persons who can give accurate advice regarding production of high quality seeds rather than inspectors of fields for seed certification. Laboratory periods should provide experience necessary to enable employees to prepare the best possible seed from the stocks which are available from producers. For this reason, emphasis in the laboratory sessions is placed on the analysis and evaluation of seeds and on the storage and handling practices for maintaining their quality.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Species and Varieties or Hybrids	2	20
II. Storage of Seeds	2	10
III. Diseases of Seeds	2	10
IV. Weed Seeds	2	10
V. Processing and Cleaning	2	12
VI. Steps in Processing	2	12
VII. Seed Quality	2	12
VIII. Seed Injury	2	10
Total hours	16	96

Division I. Species and Varieties or Hybrids

A. Unit of Instruction
   1. Development of varieties and hybrids of legume seed, grass seed, grain, and cash crop seed
      a. Distinguishing characteristics
      b. Uses
      c. Quality

B. Laboratory Projects
   1. Secure samples of seeds of all the legumes, grass seeds, grains, and cash crops grown in different areas of the United States. Observe each of these seeds under a magnifier and list the distinguishing characteristics for the species. These distinguishing characteristics may be placed on a large chart and kept for future reference. As an alternative, sketch the distinguishing characteristics in addition to observing them under the magnifier.
   2. Students may be given as many samples as time will allow. These may first be identified and then analyzed for mixtures of legumes, grass, and other crop or weed seeds.

Division II. Storage of Seeds

A. Unit of Instruction
   1. Moisture to temperature relationship and its influence on viability of seeds
   2. Ventilation of seeds in storage
   3. Insects in stored seeds

B. Laboratory Projects
   1. Secure samples of seeds that have been stored under different conditions of temperature, moisture, or ventilation and for different periods of time, as 1 year, 2 years, or longer. Test the germination of the seeds and keep a record of the conditions under which they were stored. Make comparisons between storage conditions and viability of the seeds.
   2. Secure samples of seeds from farmers of the area or from local farm supply centers. Examine each sample for evidence of insect damage or for the presence of insects.

3. Write a report describing the kinds of storage one would recommend for the seeds distributed by a local farm supply center. Recommend a type of storage that maintains high viability in the seeds offered for sale.

Division III. Diseases of Seeds

A. Unit of Instruction
   1. Seedling diseases
      a. Seed treatments
         (1) regulations
         (2) effectiveness
         (3) labeling
         (4) dangers of application
         (5) contamination in commercial grain
      b. Seed-borne diseases controlled by treatment
      c. Seed-borne diseases not controlled by treatment

B. Laboratory Projects

1. Take a field trip to a commercial seed house where arrangements have been made to observe seed treatment processes. Observe the materials being used for treatment, the method of treating, and the precautions observed.
2. Secure a sample of seeds and divide it into three parts. Leave one part untreated. Treat the second part using the recommended rate of treating and treat the third portion using double the recommended rate. Plant the seeds from each part. Observe the seedlings over a period of 6 to 8 weeks. Record evidence that the treatment:
   a. Affected germination
   b. Decreased incidence of seedling disease
3. Secure a sample of seeds with a moisture content of 16 to 17 percent. Divide into four parts. Treat one of the parts according to the directions for the chemical used and test the treated and untreated seeds for germination. Keep the treated and one of the untreated parts in suitable storage for later treatment. The other two parts should be brought to 13.5 to 14 percent moisture. Treat one part and test both for germination. Keep these samples in suitable places for later testing. Prepare a report showing the effect of seed treatment on seeds which are high in moisture as compared with similar seeds with lower moisture content
4. Test the effect on germination of treatment of seeds with broken or damaged seed coats.
5. Prepare a label for a package of treated seeds meeting the requirements of government regulations for labeling.
6. Assume you are employed by a farm supply store. Prepare a newsletter for the customers describing the availability from the store of treated seeds. Explain the advantages of the seed treatment, the varieties offered, and the reason the farmer would profit by using these seeds.

Division IV. Weed Seeds

A. Unit of Instruction
   1. Kinds and identification
      a. Characteristics for separation from seeds
         (1) size
         (2) shape
         (3) characteristic of the seed coat

B. Laboratory Projects
   1. Collect samples of weed seeds common to the area. Study the characteristics of each of these and identify them. Relate the seeds to their respective plants by securing a chart from a farm chemical supplier or seed supplier showing pictures of the weeds and their seeds. Prepare a set of slides to assist in identification.
   2. Secure samples of farm grown grass or legume seeds. Sort a sample, moving the weed seeds to one side and the grass or legume seeds to the other side. Sketch the weed seeds and compare them with the legume or grass seeds in terms of size, shape, and seed coat. Describe a device which would separate the seeds mechanically.

Division V. Processing and Cleaning

A. Unit of Instruction
   1. Basis of separation
      a. Size of seed

        - b. Specific gravity of seed
        - c. Length of seed
        - d. Shape of seed
        - e. Texture and characteristics of seed coat
    - 2. Equipment
        - a. Types and kinds
        - b. Function and efficiency
        - c. Cleaning and care
    - 3. Testing shrink and ability to process seeds using:
        - a. Hand sieves and screens
        - b. Table models

B. Laboratory Projects

1. Use the machines in the laboratory to separate weed seeds from seed samples. Recheck the sample by hand sorting a sample of the seeds. Compute the effectiveness of machine cleaning.
2. Repeat No. 1 using legume seeds, grass seeds, and grain and cash crop seeds, as time will allow. Prepare a label for each sample showing the percentage of contamination before and after cleaning with the appropriate machine.
3. Use the manual and adjust the machines in the laboratory. Test the efficiency of each machine at each setting in cleaning a sample of seed. Consider the factors of importance when setting the machine for cleaning a specific lot of seeds.
4. Repeat for each of the seed cleaning machines in the laboratory.
5. Secure several samples of seeds; check each sample using the table model equipment in the laboratory to determine shrinkage from removal of foreign material. Observe the ability of the machines to remove foreign material. Record the results for each sample.

Division VI. Steps in Processing

A. Unit of Instruction

1. Perfect adjustment of machine
2. Constant checking for adjustment
3. Sampling and checking efficiency
4. Treating—value and use
    - a. Inoculation
    - b. For disease
    - c. For insects
    - d. Coloring regulation
5. Packaging
6. Labeling

B. Laboratory Projects

1. Each student is assigned several samples of seeds representing legumes, grasses, grains, and cash crop seeds commonly found in the area.
    - a. Determine the amount of shrinkage incurred if the seeds were purchased from a farmer in the area.
    - b. Determine the ability of the available machinery (in the laboratory or at the local farm supply center) to clean the seeds to an acceptable standard.
    - c. Clean the seeds to an acceptable standard in line with your estimate, adjusting the machines for the process.
    - d. Prepare the information which should appear on the label when the seeds are cleaned and packaged.
    - e. Present a record of the original seeds, the material removed, and the analysis of the finished product.
2. Using selected packages of the seeds from the above project, treat for inoculation, diseases, and insects. Treated seeds subject to the Food and Drug Administration regulation on coloring must be colored to conform to the regulation.
3. Clean the equipment to avoid contamination of succeeding samples of seeds through foreign materials, mixtures of seeds or chemical residues. The teacher assisting students to inspect machines after they are cleaned, rotating this assignment among the students.

Division VII. Seed Quality

A. Unit of Instruction

1. State and Federal seed laws
2. State seed certification standards
    - a. Field standards
    - b. Seed standards
3. Varietal mixtures, other crops, weed seeds, uniformity, color, diseases
4. Sampling
5. Analysis procedures
6. Germination
    - a. Standard germination

    - b. Paper-doll germinators
    - c. Petri dishes
    - d. Care with large seeded legumes
    - e. Checking with soil
    - f. Cold test for corn
    - g. Dormancy in seeds

B. Laboratory Projects

1. Observe field inspection for seed certification. Each student may be assigned a portion of a field to inspect, and then compare his findings with the official inspection report.
2. Take a field trip to a State seed certification laboratory. List the factors used in the laboratory inspection for certified seeds. Each student may secure a sample of seed to analyze for conformity to State seed certification standards. Compare the findings with the official report.
3. Take a field trip to the State seed control laboratory to observe the procedures used for control of seed quality. Secure samples of seeds which each student may analyze and compare with the findings of the laboratory. Compare the methods of the State seed control laboratory and the seed certification laboratory.
4. Test several samples of seeds for germination. The cold test and standard germination test may be used for corn. Compare standard germination tests, paper-doll tests, and others using seeds from the same sample.

Division VIII. Seed Injury

A. Unit of Instruction

1. Seed damage in:
    - a. Harvest
    - b. Handling
    - c. Storage

B. Laboratory Projects

1. Collect samples of seeds showing damage. Identify the cause of each kind of damage. Prepare a chart showing kinds of damage occurring in harvesting, handling, and storage. Show the causes in each case. Indicate the method to use to avoid damage. Illustrate the chart with pictures and sketches.
2. Visit a farm where seeds are being harvested. Check damage to the seeds from the harvester (combine or other machine) and make adjustments to correct the cause of damage. Prepare a newsletter suitable for a farm supply center to send to customers which will give directions for avoiding damage to grain or seeds at harvest time. Include in the letter suggestions for avoiding or minimizing damage due to the weather at harvest time.
3. Visit a commercial seed house where seeds are being conditioned. Collect samples of the seeds and examine them for damage due to handling in the plants. Determine the causes of the damage and prepare a report to the manager explaining the nature of the damage and the method for correcting it.
4. Visit a farm supply center or seed storage warehouse. Note possible ways in which seeds may be damaged in storage. Prepare an exhibit to show methods of storage to avoid damage to the seeds.

TEXTS AND REFERENCES

Cereal Millers Handbook.

Cotton, *Pests of Stored Grain and Grain Products.*

Heckendorn and Sutherland, *Report of the Nineteenth Hybrid Corn Industry-Research Conference.*

International Crop Improvement Association, *Minimum Seed Certification Standards.*

Simmons, *Feed Milling and Associated Subjects.*

Sutherland, *Report of Seventeenth Hybrid Corn Research Conference.*

U.S. Department of Agriculture, *Seeds.*

———, Agricultural Research Center, *State Noxious Weed Seed Requirements Recognized in Administration of Federal Seed Act.*

VISUAL AIDS

Films

Crop Quality Council, 828 Midland Bank Building,
Minneapolis, Minn. 55401.

Man Against a Fungus. 35 min., 16 mm., color, sound.

E. I. Dupont de Nemours and Company, Inc., Industrial and Chemicals Division, Wilmington, Del. 19801.

Lost Harvest. 20 min., 16 mm., color, sound.

Farm Film Foundation, 1425 H Street, N.W., Washington, D.C. 20005.

Breeding Better Corn. 27½ min., 16 mm., color, sound.

Breeding Corn for Today's Farming. 15 min., 16 mm., color, sound.

Great Story of Corn. 30 min., 16 mm., color, sound.

Virginia Crop Improvement Association, Blacksburg, Va. 24060.

For a Seed Has Sprouted. 27 min., 16 mm., color, sound.

Soil Science II: Fertilizers

HOURS REQUIRED

Class, 2; Laboratory, 6. Prerequisite: *Soil Science I: Fertility.*

COURSE DESCRIPTION

The course is designed to prepare students for work in the fertilizer departments of farm supply centers. Materials included will develop the ability to formulate fertilizers in bulk plants and to interpret soil tests for the purpose of making intelligent recommendations regarding fertilizers.

Soil testing is included in this course, along with a very brief review of soil types, to develop in the students an understanding of the basic materials and methods from which recommendations are made. Official soil testing laboratories are available throughout the United States, so that it is not desirable in this program to train students to be expert soil testers. However, it is essential that they understand how soil tests are made, that they are able to interpret the tests to their customers, and that their interpretations are technically correct.

The laboratory projects are planned to develop understanding of fertilizers and their use from the point of view of an employee in a business serving the farmer. In this very rapidly changing aspect of the industry, students and employees as well as managers need to be constantly alert to the new discoveries and techniques which are revolutionizing the industry. Instructors study current literature to keep their libraries and equipment up-to-date and to keep abreast of the changing technology of the fertilizer industry. Instructors, both in class sections and in the laboratory sections, encourage students to review current literature, bulletins, and magazines from fertilizer manufacturers and distributors to make sure that their recommendations are based on the latest available information.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Soil Moisture and Plant Growth	2	8
II. Fertilizer Requirements for Plant Growth	2	14
III. Fertilizers of the Soil	4	14
IV. Soil Micro-Organisms and Fertilizer Availability	3	6
V. Sources of Raw Material and Production of Fertilizers	3	2
VI. Formulation of Fertilizers	4	12
VII. Recommending a Fertilizer Including Lime	3	8
VIII. Methods of Application of Fertilizers	3	14
IX. Loss of Fertilizer	2	4
X. Storage of Fertilizers	2	4
XI. Lawn and Garden Fertilizers	2	6
XII. Use of Micro-Nutrients	2	4
Total hours	32	96

Division I. Soil Moisture and Plant Growth

A. Unit of Instruction

1. Soil moisture-holding capacity
2. Wilting co-efficient
3. Draining and irrigating for optimum moisture
4. Relation of organic material

B. Laboratory Projects

1. Select two mineral soils, one low in organic matter and one high in organic matter. Plant beans, corn, or other crop seeds in flower pots in each of the soils. When true leaves have developed, do the following:
    a. Place some of the plants growing in each soil in a pan of water up to the level of the soil.
    b. Place others in a pan with water up about 1 inch in the pot.
    c. Place others where they will be kept moist but well drained.
    d. Record the effect of the treatments on the plants.
2. Select mineral soils as in 1 above and plant beans, corn, or other crop seeds in the same way. When true leaves have developed, do the following:
    a. Provide check plants with normal amounts of water each day.

   - b. Give another group a limited amount of water each 3 days, approximately one third that given the check plants.
   - c. Give the third group approximately the same amount of water as the second group, but provide it only once each week.
   - d. Record the effect of the drought periods on the growth of the plants.
3. Make a demonstration to simulate flooding. Cover plants with water for periods of 1 day, 3 days, and 7 days; then drain. Record the effect of flooding on the growth of the plants.
4. Compare the effects of the treatments between the two soils.

Division II. Fertilizer Requirements for Plant Growth

A. Unit of Instruction
   1. Roots
   2. Tops
   3. Seeds

B. Laboratory Projects
   1. Prepare a chart showing the major nutrients necessary for the growth of roots, tops, and seeds in plants. Do this by sketching a plant and labeling the food elements most important for the production of each part of the plant.
   2. Draw a map of a selected field for a soil testing project. On the map show the contours of the field and indicate the differences in soil types. Locate points on the map where soil samples are to be taken. Take the soil samples as indicated on the map.
   3. Test the soil samples for N. P. K. Record results on a form furnished by the instructor.

Division III. Fertilizers of the Soil

A. Unit of Instruction
   1. Soil type and fertilizer elements available
      - a. Phosphorus
      - b. Potash
      - c. Nitrogen
      - d. Calcium
      - e. Micro-nutrients

B. Laboratory Projects
   1. In cooperation with one or two other students make a soil monolith of a soil type that is typical of the area. Prepare a report on the soil type, indicating the kinds of fertilizer elements normally found in the soil type and those that are likely to be deficient in that soil.
   2. Collect fresh tissues of plants grown on the soil types that have been studied, run tissue tests on the material, and record the results. Compare these actual results with those that were anticipated.
   3. Set up a demonstration in the laboratory with one plant in each of five earthenware jars. Use jars approximately 2 gallons in size and with an opening on the side near the bottom. Plant the plants in clean quartz sand. Water the plants with distilled water in which a fertilizer mixture minus one element has been dissolved. Observe the evidence of a nutrient deficiency over a period of a few weeks.

Division IV. Soil Micro-Organisms and Fertilizer Availability

A. Unit of Instruction
   1. Soil type and activity of organisms
      - a. Phosphorus
      - b. Nitrogen
      - c. Potash
      - d. Calcium

B. Laboratory Projects
   1. Collect samples of soil from as many local soil types as possible. Determine the percentage of organic matter in each sample of soil. Compare the percentage of organic matter found in the samples.
   2. Take a sample of soil from an area known to be productive. Cover it with plastic or some other material to prevent drying of the soil, and arrange to aerate it daily. Place part of the sample in a refrigerator for 2 weeks; place another part of the sample at optimum temperature for crop growth for the same period; and place a third portion at a high temperature, 80° to 90° C., also for 2 weeks.

      Remove each portion and immediately test for N. P. K. List any evidence noted of a relationship between temperature and the availability of plant nutrients. Explain results.

Duplicate this project using other soil types to compare in terms of type and percentage of organic matter.

Division V. Sources of Raw Material and Production of Fertilizers

A. Unit of Instruction
  1. Dry fertilizers
    a. Phosphorus
    b. Nitrogen (forms and sources)
    c. Potash
    d. Calcium
    e. Micro-nutrients
  2. Liquid fertilizers
  3. Anhydrous ammonia

B. Laboratory Projects
  1. Use an outline map of the United States to locate the areas from which elementary ingredients are obtained for fertilizer production. The sources of different materials may be identified by colors. For materials which are normally imported, show the import routes approaching the United States and label to indicate the country of origin.
  2. Locate on the map the major areas where the fertilizer components are processed to make fertilizer ingredients.
  3. Visit a local bulk fertilizer plant and list the fertilizer ingredients being used to formulate fertilizer. Determine the percentage of plant nutrients in each of the ingredients.
  4. Use the data obtained on the field trip to compute the amount of each fertilizer ingredient to use to prepare a fertilizer with a specific formula.
  5. Secure a fertilizer recommendation bulletin from the State agricultural experiment station. Using this bulletin, compute the plant food ingredients needed to make the fertilizers which are recommended for the soil types and soil tests made in earlier projects.

Division VI. Formulation of Fertilizers

A. Unit of Instruction
  1. Dry and liquid
    a. Meaning of N. P. K. and N, P_2O_5, K_2O in the formula (dual labeling)
    b. Mixing
    c. Storage
  2. Relation to manure—barnyard and green

B. Laboratory Projects
  1. Secure plant food elements found in the liquid fertilizer solutions commonly used in the area. Compute the quantity of each needed in preparing mixtures of specified ratios of plant food.
  2. List the sources of micro-nutrients and indicate the crops which are most likely to respond to them. Make a chart on which are listed the crop, the micronutrients needed, and the carrier or carriers of each.
  3. Visit a local fertilizer distributor who sells and applies anhydrous ammonia. List how the distributor determines the amount of nitrogen being applied per acre.
  4. Write a report which describes the kind of storage facilities a farm supply center would need to store dry fertilizer ingredients and the kind of storage needed to store liquid fertilizer ingredients.

Division VII. Recommending a Fertilizer Including Lime

A. Unit of Instruction
  1. Interpretation of soil tests
  2. Cropping program
  3. Dry, liquid, or anhydrous
    a. Starter
    b. Complete
    c. Supplemental
  4. Maximum production desired
  5. Cost per unit of plant nutrients

B. Laboratory Projects
  1. Secure a number of soil test results from a county or regional soil testing laboratory. Assume you are employed by a local farm service center where customers bring reports of soil tests and ask for a recommended fertilizer program. Select as many of these reports as time will permit and write for each one the recommendations for a fertilizer program. Include the plant food ratio; the rate, time, placement, and method of application; and recommendations for supplemental applications during the season. Include recommendations

for fertilizer applications on succeeding crops in the rotation or crop sequence.

2. Prepare recommendations as in No. 1 for fertilizer applications and other practices for specified production of local major crops. For example, if you are selecting corn as a typical local crop, recommend the ratio, rate of application, and time of application of the fertilizer, the plant population, planting dates, and other practices needed to produce a specified optimum yield of corn.
3. Review the available literature and prepare a summary which shows the importance of lime for maintaining optimum pH for crops grown. Also show the relation of lime in the soil to availability of plant nutrients.
4. Use records of the soil tests made earlier to recommend the application of lime for the local production of major crops.
5. Recommend a fertilizer that will give spring-planted crops a quick start while the soil is still too cold for action of bacteria to release nitrogen.
6. Secure an area where plots can be laid out to demonstrate the effect of fertilizers and lime. Determine what should be shown and plant a series of plots to demonstrate results that are needed. Include check plots against which to make comparisons.
7. Obtain the prices per ton of fertilizers sold locally, together with the analysis of each one. Compute the cost per unit of plant food for each of the analyses available.

Division VIII. Methods of Application of Fertilizer

A. Unit of Instruction

1. Broadcast
2. Drilling
3. Irrigation water
4. Combination of broadcast and drilling
5. Spraying
6. Time of application
7. Placement
8. Cost and returns

B. Laboratory Projects

1. Visit a farm machinery dealership to study the machines available for applying fertilizer. Obtain a series of pictures or color slides to illustrate the machines and prepare a written report to accompany the pictures, describing how fertilizers are applied by each one and explaining the advantages of each in such terms as the cost of application and placement of the fertilizer.
2. Assume you are employed as a farm service advisor at the local farm supply center. Prepare a report to submit to the manager regarding the advisability of the firm's providing a custom service for the application of fertilizer. Explain how the fertilizer would be applied and include recommendations for applying some of the fertilizer by broadcasting and some by drilling. Indicate recommendations for applying supplemental fertilizer on a custom basis.
3. Assume you are an outside salesman selling fertilizer locally. Prepare a map of the local area showing the boundaries of the territory beyond which it would not be economical to deliver fertilizer. Compute man-hours and truck cost for delivering fertilizer within the territory. Compute the costs on a basis of radii 1 mile apart and extending to the practical boundaries of the territory. Provide the necessary assumptions such as:
   a. Form of the fertilizer, as dry, liquid, or other
   b. Size of truck
   c. Margin for the fertilizer

   Recommend delivery rates for successive mile radii and prepare a chart for use at a farm supply center to indicate the delivery policy to customers.
4. Assume the same position as in No. 2. Prepare copy for a brochure to mail to your customers and others in the service area showing the costs and returns they can reasonably expect from the use of fertilizer applied according to recommendations. Supply supporting data in the

brochure, along with pictures which illustrate experiences of neighbors.

5. The class visits a farm where a fertilizer applicator is available. The teacher assigns a committee of the class to demonstrate a method of calibrating the fertilizer applicator. The teacher repeats this demonstration by using other committees and kinds of applicators.

Division IX. Loss of Fertilizer

A. Unit of Instruction
   1. Leaching
   2. Erosion
   3. Volatilization
   4. Tied up by the soil and pH
   5. Action of soil micro-organisms

B. Laboratory Projects
   1. Visit a field that has been affected by erosion. Secure samples of soil from portions of the area which are eroded and from areas which are not eroded. Test the samples for nitrogen, phosphorus, and potash; and compare the plant nutrients from the eroded soil and from the soil which is not eroded. Prepare a report explaining the findings.
   2. Collect samples of the drainage water from a tile-drained field and test for N. P. K. Determine the loss of plant food by leaching.
   3. Prepare a demonstration as follows: Place filter paper in two funnels and fill with quartz sand. Pour a well-colored but weak solution of gentian violet dye into one of the funnels and a similar solution of eosin dye into the other funnel. Make a 0.1 per cent solution of gentian violet and a 0.5 per cent solution of eosin to serve as a stock solution. Dilute 5 ml. of the stock solution in 500 ml. for the demonstration. Be careful not to pour too much of the dye solution into the funnels but enough to go through and into the beaker below. Note that the gentian violet comes through clear, and the eosin solution comes through colored. The charge of the gentian violet is positive; the charge of the eosin is negative. This indicates that the surface of the quartz particles has a negative charge, since it absorbed the gentian violet but allowed the eosin to pass through. Add some distilled water to the funnels to show that the gentian violet is not washed out, whereas the stain on the sand from the eosin dye can be washed through.

      Add equal amounts of gentian violet and eosin dye solutions to a sample of soil in a flask. Shake well and then pour out into a funnel fitted with a filter paper. The positively charged particles of the gentian violet are absorbed by the soil and the negatively charged particles of the eosin are not.

      When a fertilizer such as KNO_3 is applied, the $K+$ can be retained, but the NO_3— can be readily leached out. Application can be made to practical soil management by relating soil texture and the nature of the fertilizer used. Nutrients in finely textured soils are less susceptible to leaching than those in coarsely textured soils.

      Prepare supplementary materials to accompany the preceding demonstration and prepare a presentation to make to farmers to emphasize the importance of adequate soil and fertilizer management.
   4. Prepare a demonstration to show the cation exchange in acid soils when lime is added. An effective demonstration may be developed as follows: Place filter paper in each of two funnels and fill the funnels with an acid soil; leach the soil in one of the funnels with a 1/10 percent solution of potassium nitrate (1 gram in 1,000 grams of water); leach the soil in the other funnel with distilled water; and add a few drops of soil-tex indicator to both leachates.

      The pH of the leachate from the soil where the potassium nitrate salt was used will be relative low. This is because the ions in the solution replaced the exchangeable hydrogen ions and combined with the nitrate ions to form nitric acid. This replacement did not occur in the distilled water because the water does not contain any cations to act as replacing ions. Soils are acid due to the presence of hydrogen ions on the clay particles. The addition of lime will cause an exchange to take place so that the hydrogen ions will be replaced by calcium ions.

Prepare a demonstration, together with supplementary materials, such as charts, specimens, and fertilizer materials, for a presentation before a meeting of farmers. Emphasize the importance of adequate liming of acid soils for efficient crop production.

Division X. Storage of Fertilizers

A. Unit of Instruction
  1. Storage conditions
  2. Storage life
  3. Reconditioning
  4. Safety precautions

B. Laboratory Projects
  1. Visit a local farm supply center where fertilizers are sold. Study the storage facilities used to store bulk fertilizer ingredients, liquid fertilizers, and bag fertilizers. Ask the manager what storage problems he encounters in each case and what storage conditions he needs to maintain.
  2. For each of the fertilizer ingredients, prepare a record of storage life for the material and describe the reconditioning which will be needed if the material is to be used in the next season.
  3. Prepare recommendations for the manager describing the safety precautions he must observe in the storage and in the handling of all kinds of fertilizers.

Division XI. Lawn and Garden Fertilizers

A. Unit of Instruction
  1. Lawn and garden application
     a. Formulation
     b. Time

B. Laboratory Projects
  1. Prepare a lawn fertilization program for a year. Recommendations to include are fertilizer analysis, rate of application per 1,000 square feet, and supplemental treatments to support an excellent lawn. Supplemental treatments include insect and weed control treatments, irrigation or drainage, and mowing.
  2. Using appropriate ingredients, compute the formulation to use to make the recommended fertilizer.
  3. Prepare the recommended fertilizer and apply it on a portion of the school lawn, following approved practices. Observe the lawn once a week and record the observations regarding the effectiveness of the fertilizer treatment.
  4. Recommend the analysis of fertilizer for gardens in the area and compute the amounts of ingredients needed to prepare the fertilizer. Include the micro-nutrients deficient in local soils.
  5. Prepare a quantity of fertilizer and arrange for a local demonstration in one or more gardens. At the close of the season prepare a written report on the effectiveness of the fertilizer formula.

Division XII. Use of Micro-Nutrients

A. Unit of Instruction
  1. Detection of need
  2. Kind and amount to use
  3. Time of application

B. Laboratory Projects
  1. Bring in specimens of growing plants which are deficient in one or more plant nutrient. Use pictures to help identify the elements which are deficient. Mount the collection on cards or embed in plastic to provide a permanent collection.
  2. Obtain plants which consistently show micro-nutrient deficiencies; make arrangements to treat a portion of them in the field, leaving an untreated check. Apply the micro-nutrients with a spray on the leaves or in the soil and keep a record over a period of 3 to 4 weeks.

TEXTS AND REFERENCES

Berger, *Introductory Soils.*

Clark and Foth, *Understanding Our Soils.*

Douglas, Harre, and Johnson, *Fertilizer Trends—1964, Including TVA's Fertilizer Activities.*

Eichers, *Bulk Fertilizer Blending in Upper Midwest.*

Hignett, *Bulk Blending of Fertilizers: Practices and Problems.*

Markham, *The Fertilizer Industry, A Study of an Imperfect Market.*

McVicker, Bridger, and Nelson, *Fertilizer Technology and Usage.*

Shepard and Mahn, *Fertilizer Situation.*

Sprague, *Hunger Signs in Crops.*

Tennessee Valley Authority, *Change and Challenge.*

———, *Facts About the Fertilizer Business.*

———, *The Fertilizer Dealer.*

———, *New Developments in Fertilizer Technology.*

U.S. Department of Agriculture, Agricultural Research Service, *Effect of Soils and Fertilizers on Nutritional Quality of Plants.*

VISUAL AIDS

Films

American Potash Institute, 1102 – 16th Street, N.W., Washington, D.C. 20036.

Good Alfalfa Requires Good Fertility. 10 min., 16 mm., color, sound.

Growing Alfalfa Successfully. 25 min., 16 mm., color, sound.

Farm Film Foundation, 1425 H Street, N.W., Washington, D. C. 20005.

How To Use Nitrogen Solutions. 14 min., 16 mm., color, sound. (Not available in the Far West.)

How To Weed While You Fertilize. 14 min., 16 mm., color, sound. (Not available in the Far West.)

Nitrogation Is Good News. 18 min., 16 mm., color, sound. (Not available in the Far West.)

Modern Talking Picture Service, Inc., 3 East 54th Street, New York, N.Y. 10022.

Nature's Need for Nitrogen. 25 min., 16 mm., color, sound.

Out of the Earth. 28 min., 16 mm., color, sound.

National Plant Food Institute, Film Department, 1700 K Street, N.W., Washington, D.C. 20006.

The Big Test. 15 min., 16 mm., color, sound.

Deeper Acres. 28 min., 16 mm., color, sound.

The Land—Legacy and Promise. 31 min., 16 mm., color, sound.

What's In the Bag? 18 min., 16 mm., color, sound.

Union Pacific Railroad, Omaha, Nebr. 68101.

It's Time to Irrigate. 10 min., 16 mm., color, sound.

Washington State University, Pullman, Wash. 99163.

Water Movement in the Soil. 27 min., 16 mm., color, sound.

Filmstrips and Slides

American Potash Institute, 1102– 16th Street, N.W., Washington, D.C. 20036.

Fertilizer Application for Top Profits. 48 frames, 35 mm., color.

Potash Deficiency Symptoms. 22 frames, 35 mm., color.

Potassium Hunger Symptoms. Forty 2 x 2 slides, 35 mm., color.

Soil Fertility and Soybeans. Forty-two 2 x 2 slides, 35 mm., color.

Successful Alfalfa—You Can Grow It. Forty 2 x 2 slides, 35 mm., color.

Ten More Bushels of Soybeans. Fifty-one 2 x 2 slides, 35 mm., color.

National Fertilizer Solutions Association, 910 Lehmann Building, Peoria, Ill. 61602.

Don't Be an Idiot. Ninety-three 2 x 2 slides, 35 mm., color, mimeographed script or tape.

Rapid and Safe Handling of Fertilizer Solutions. Sixty-two 2 x 2 slides, color, 35 mm., with tape or mimeographed script.

FIGURE 30.—Technician students practice with modern soil testing equipment.

Structure of the Grain, Feed, Seed, and Farm Supply Industry

HOURS REQUIRED

Class, 3.

COURSE DESCRIPTION

The course is designed to give beginning students an overview of the industry they are entering. They will develop an understanding of the geographic areas of production throughout the world, the relationship of these areas of production, the economic inter-relationships of the many segments of the industry, and a concept of the importance of the industry to the economy of the nation.

The services performed at each step in the cycle of food production are examined in the course. These include the services rendered to farmers through the sale of fertilizers, chemicals, seeds, and other supplies. Services performed in the purchase of farm produce and the steps in moving these from country points through the market channels to consumers are emphasized.

The location of many segments of the industry, such as terminal elevators, manufacturing plants, and processing establishments are discussed. Their relationships to transportation routes, to centers of supply, and to centers of population are analyzed.

Current trends in integration, both vertical and horizontal, are also included in the units.

It is suggested that instructors assist in building an extensive library of references for this course. There are no suitable textbooks covering the total field; however, instructors will find a fairly large number of publications listed in the bibliography from which course materials may be developed. In addition, it is suggested that the agricultural colleges of State land grant institutions be contacted for materials which may be available in the State.

MAJOR DIVISIONS

	Class Hours
I. The Country Elevator and Farm Supply Store	8
II. The Terminal Elevator	7
III. Manufacturers as Part of the Industry Structure	7
IV. Export as Part of the Industry Structure	6
V. Transportation: Influence on the Industry Structure	6
VI. Structure of the Fertilizer Industry	8
VII. Trade Associations: A Part of the Industry Structure	6
Total hours	48

Division I. The Country Elevator and Farm Supply Store

Unit of Instruction

1. What is expected of employees
2. Types of country elevators and farm supply stores
   - a. Grain handling businesses
   - b. Grain storage elevators
   - c. Multi-complexes (including elevator and farm supply business)
   - d. Farm supply business with no elevator
3. Number of country elevators and farm supply stores
   - a. Number of each type
   - b. Classified by size of business
4. Location of the business in relation to:
   - a. Areas of production
   - b. Transportation routes
   - c. Centers of population
5. Services performed by the country elevator and farm supply store
   - a. Serves as an outlet for farm grain
     - (1) purchase of grain
     - (2) conditioning of grain
     - (3) storage of grain
   - b. Serves as a source of supply of grain for terminal elevators, processors, and others
   - c. Serves as a source of supply for farmers and ranchers
     - (1) feeds and feed supplements
     - (2) fertilizers
     - (3) agricultural chemicals
     - (4) seeds
     - (5) other supplies
6. Ownership of the country elevator and/or farm supply store
   - a. Individual ownership
   - b. Partnership
   - c. Corporation
     - (1) line company
     - (2) single or multiple-unit corporation

d. Cooperative
   (1) line cooperative
   (2) single or multiple-unit cooperative

7. Types of integrated organizations
   a. Integration defined
   b. Horizontal integration
   c. Vertical integration
8. The changing structure of the country elevator and farm supply store
   a. Changes in the variety of lines
      (1) new lines of merchandise and services to local customers
      (2) changes in functions performed in the total distribution pattern
         (a) direct selling
         (b) more functions of the terminal elevator assumed by the country elevator
         (c) changes in storage of grain (more stored at local points)
   b. Influence of government binsites
   c. Influence of farm processing, drying, and feed mixing

Division II. The Terminal Elevator

Unit of Instruction

1. Types of terminal elevators
   a. Storage warehouses
   b. Export houses
   c. Supply sources for processors
2. Number of terminal elevators
   a. Number of each type
   b. Classification according to size of business (capacity)
3. Location of terminal elevators in relation to:
   a. The areas of production
   b. Transportation routes
   c. Centers of population
4. Function of terminal elevators
   a. Assemble and store grain
   b. Process grain—blend, condition grain
   c. Supply grain to domestic and export trade
5. The changing structure of the terminal elevator
   a. Effect of the changing CCC storage operations
   b. Competition of the country elevators for the terminal function
   c. Economics of operation

Division III. Manufacturers as Part of the Industry Structure

Unit of Instruction

1. Feed manufacturers
   a. Types
      (1) large, centralized manufacturing plants
      (2) small, regional operators serving a number of outlets in a region
      (3) local operators mixing feed for local farmer-customers
   b. Number of feed manufacturers of each type
   c. Location of feed manufacturing plants in relation to:
      (1) source of material
      (2) market outlets
      (3) transportation routes
   d. Function and services of feed manufacturing firms
      (1) formulate feeds for the trade
      (2) use by-products from flour, brewing, and other industries
      (3) kinds and quantities of grain used
   e. The changing structure of the manufacturing industry
      (1) changes in size and location of feed manufacturing plants
      (2) changes in degree of integration of manufacturing plants
         (a) horizontal integration
         (b) vertical integration (backward and forward)
2. Flour mills
   a. Types
      (1) large, centralized mills
      (2) small, regional mills serving a number of outlets
      (3) local operators manufacturing flour for a small territory
   b. Number of flour mills of each type
   c. Location of flour mill plants in relation to:
      (1) source of materials
      (2) market outlets
      (3) transportation routes
   d. Function and services of flour manufacturing firms
      (1) formulate flour for the trade—flour adapted to specific purposes

        - (2) kinds and quantities of grain used
    - e. The changing structure of the flour milling industry
        - (1) changes in size and location of flour milling plants
        - (2) changes in degree of integration of plants
- 3. Cereal manufacturers (same format as above)
- 4. Brewers (same format as above)

Division IV. Export as Part of the Industry Structure

Unit of Instruction

- 1. Types of export operations
    - a. Export firms with facilities in the United States and foreign countries
    - b. Export firms without facilities in foreign countries
- 2. Number of exporters of each type
- 3. Location of export operations in relation to:
    - a. Source of materials
    - b. Transportation routes and rates
- 4. Function and services of the export industry
    - a. Volume of grain produced in the United States that is exported
    - b. Assemble, condition, and ship export grain
        - (1) buy it from a terminal
        - (2) export firm owns elevators
- 5. The changing structure of the export operations
    - a. Effects of CCC operations
    - b. Effect of freight rates on location of operations

Division V. Transportation: Influence on the Industry Structure

Unit of Instruction

- 1. History of the development of transportation in the United States
    - a. Influence on the structure of the grain, feed, and fertilizer business
    - b. Relation of development of transportation to the development of major areas of grain, forage, and livestock production
- 2. Influence of government policies and subsidies on the evolution of transportation as it affects grain, feed, livestock, and fertilizer industries.
- 3. The present relationship of structure of the grain industry and transportation

Division VI. Structure of the Fertilizer Industry

Unit of Instruction

- 1. Sources of industry supply
    - a. Nitrogen
    - b. Phosphorus
    - c. Potash
- 2. Types of processing plants
    - a. Plants producing fertilizer ingredients
        - (1) ammonia and nitrogen compounds
        - (2) phosphate compounds
        - (3) potash compounds
    - b. Plants formulating complete fertilizers
        - (1) central plants
        - (2) bulk mixing plants
- 3. Number of processing plants
    - a. Central plants
    - b. Bulk mixing plants
- 4. Location of plants in relation to:
    - a. Source of material
    - b. Market outlets (centers of use)
    - c. Transportation
- 5. Types of retail outlets
    - a. Farm service center
    - b. Direct sales, manufacturer to farmer
    - c. Specialized fertilizer dealers
- 6. The changing nature of retail outlets
    - a. Bulk plants
    - b. Liquid and slurry fertilizers
    - c. Anhydrous ammonia
    - d. Custom application
    - e. Dealer services
        - (1) soil tests, or recommendations based on tests
        - (2) fertility, cropping program
        - (3) serving as a source of information for farmers
- 7. Use of fertilizer in:
    - a. United States
    - b. Individual States
    - c. The area served by the local business
    - d. Percentage of acreage of crops on which plant nutrients are used

Division VII: Trade Associations: A Part of the Industry Structure

Unit of Instruction

- 1. Trade associations serving:
    - a. The grain industry

    b. The feed industry
    c. The seed industry
    d. The fertilizer industry
2. Types of associations serving each of the above segments of the industry
3. Functions of each type of trade association

TEXTS AND REFERENCES

Chicago Board of Trade, *Commodity Markets and the Public Interest.*

Freeman, *Changes in Total Market Structure and Implications of these Changes: Project 1964.*

Graves and Kline, *Receiving Grain at Country Elevators.*

Haldeman and others, *Grain Transportation in the North Central Region, an Economic Analysis.*

Heid, *Changing Grain Market Channels.*

Lamer, *The World Fertilizer Economy.*

Miklius and DeLoach, *Interstate Trucking of Exempt Agricultural Commodities, California.*

Miller and Nelson, *Relationship between the Grain Processing Industries and Federal Anti-Trust Laws.*

Nakamura and Hieronymus, *Structure of the Soybean Processing Industry.*

Richey and Johnson, *Factors To Be Considered in Locating, Planning and Operating Country Elevators.*

Schonberg, *The Grain Trade: How It Works.*

Steen, *Flour Milling in America.*

Wheat Flour Institute, *From Wheat to Flour, The Story of Man . . . In a Grain of Wheat.*

Wright, *Changes in Transportation Used by Country Elevators in North Central Region, 1958–63.*

———, *Transportation and the Grain Industries.*

VISUAL AIDS

Films

Sterling Movies, U. S. A., 375 Park Avenue, New York, N.Y. 10022.

The Grain Merchants. 30 min., 16 mm., color, sound.

U.S. Department of Agriculture, Office of Information Services, Washington, D.C. 20250.

Agricultural Lifelines. 13 min., 16 mm., color, sound.

General Courses

Agricultural Economics and Marketing

HOURS REQUIRED

Class, 3. Prerequisite: *Structure of the Grain, Feed, Seed, and Farm Supply Industry.*

COURSE DESCRIPTION

The course is designed to develop an understanding of basic principles of economics and the ability to apply these principles to the distribution and marketing of grain, feed, seed, and farm supplies. An understanding of the role of the middleman in the distribution of agricultural supplies and the marketing of farm products is essential for satisfactory performance by many who will be employed as technicians in the industry.

The services performed by those middlemen who assemble products from the farm and who supply materials to the farm are essential in the economy. Those who are preparing for employment in the industry need to be aware of the function and to understand the relationship of economic principles to the success of this aspect of the national economy.

The role of government is a very important influence on the total agricultural distribution system. Historically, the government has taken an active part in controlling monopolies, as well as in farm programs designed to control production, stabilize prices, and provide for a continuous flow of farm products to the market. The influence of these types of government programs on the economic system needs to be understood by students who are in training for technician positions in the grain, feed, seed, and farm supply industry.

Emphasis needs to be placed on the influence of government taxation and spending programs and their effect on agricultural production and distribution. The student needs to be able to understand and evaluate these influences on the industry for which he is training.

This course should provide the student with a sound basis for the course, *Grain Handling, Warehousing, and Merchandising,* scheduled for the third semester.

MAJOR DIVISIONS

		Class Hours
I.	The Supply of Agricultural Products (Feed Grains, Food Grains, Oil Crops, Livestock, and Poultry)	7
II.	The Demand for Agricultural Products (Feed Grains, Food Grains, Oil Crops, Livestock, and Poultry)	7
III.	Functions of Marketing	8
IV.	Market Prices	8
V.	Futures Trading	6
VI.	International Marketing Barriers	6
VII.	Vertical Integration in Agricultural Marketing	6
	Total hours	48

Division I. The Supply of Agricultural Products (Feed Grains, Food Grains, Oil Crops, Livestock, and Poultry)

Unit of Instruction

1. Areas of production
   a. World
   b. United States
2. Changing production patterns
   a. World
   b. United States
3. Supply as affected by national and international agricultural programs
   a. International
      (1) pricing policies
         (a) International Wheat Agreement
         (b) International Grain Agreement
      (2) economic integration
         (a) European Economic Community
         (b) European Free Trade Area
      (3) Agency for International Development
   b. National price support operations

Division II. The Demand for Agricultural Products (Feed Grains, Food Grains, Oil Crops, Livestock, and Poultry)

Unit of Instruction

1. Consumption by areas of the world
2. Per capita consumption by countries

3. Factors affecting consumption
    a. Taste
    b. Population
        (1) world population by areas
        (2) projection
    c. Price
        (1) elasticity of demand
        (2) substitutes and complements
    d. Income
        (1) elasticity of demand
        (2) cross-elasticity of demand
4. Increasing consumption of agricultural products
    a. School lunch
    b. Food stamp
    c. Agricultural Trade Development and Assistance Act of 1954
    d. Agency for International Development
    e. Christian Rural Overseas Program
    f. Promotion efforts
        (1) U.S. Feed Grains Council
        (2) Great Plains Wheat
        (3) Farm Bureau
5. The question of surpluses and starvation
    a. Reasons for the situation
        (1) buying power of nations
        (2) habits and prejudices about foods
    b. How much food is needed to feed the world
    c. How much excess supply of food is there in the world

Division III. Functions of Marketing

Unit of Instruction

1. Merchandising
    a. Planning
    b. Place
    c. Time
    d. Quantities
    e. Price
    f. Quality
    g. Buying
    h. Selling
2. Assembly of marketable quantities
    a. Convenience
    b. Cost
3. Risk
    a. Shifting, lessening, assuming
    b. Price
        (1) quality deterioration
        (2) place
        (3) human
4. Financing
    a. Types of financing needs
        (1) working capital
        (2) consumer credit
        (3) capital expenditure
    b. Seasonal nature of capital needs
    c. Methods of financing and sources of funds
5. Storage
    a. Economic characteristics of storage
        (1) working stocks
        (2) seasonal nature of production
        (3) effect on price fluctuation
    b. Types of storage
    c. Public warehouses
    d. Factors influencing location of storage
    e. Regulations of warehousing
        (1) The Uniform Warehouse Receipts Act
            (a) purpose of the act
            (b) States which do not have warehousing acts
            (c) advantages and disadvantages of State warehousing acts
        (2) The U.S. Warehouse Act
6. Transportation
    a. Important cost of marketing
    b. Competitive nature of transportation
    c. Transportation industries
        (1) rail
        (2) truck
        (3) barge
        (4) air
    d. Interstate Commerce Commission and transportation regulation
        (1) 1958 Transportation Act and its effect on transportation competition
        (2) national transportation policy
    e. Effect of transportation routes, practices, and policies on competitive position of marketing firms
    f. Transit and its effect on marketing
    g. Effect of changing transportation costs

7. Standardization
   a. Reasons for grading
      (1) facilitate merchandising
      (2) communication between producer and consumer
   b. Grading and standards performed under the Agricultural Marketing Act of 1946
   c. United States Grain Standards Act
      (1) major provisions of the Act
         (a) use of grades
         (b) requirements for inspection
      (2) how grade standards are established and changed
      (3) Federal-State-local coordination in grain grading work
8. Market information
   a. Importance and source of:
      (1) USDA market information reports
      (2) other market information
   b. Obtaining information on firms, products, and area by analysis of internal records, products, territory, and customers
   c. Additional information through direct research methods such as surveys, observation, experiments

Division IV. Market Prices

Unit of Instruction

1. Purpose of price
   a. Recording exchange value
   b. Equating the forces of supply and demand
   c. Reflecting the net effect of changes in supply and demand
   d. Allocating of resources
2. Price formation
   a. Determination under pure competition
   b. Determination under imperfect competition
   c. Price discovery
   d. Relation between cash and futures prices
3. Commodity prices (optional)
   a. Livestock and meat
   b. Dairy
   c. Poultry and eggs
   d. Fats and oils
   e. Grain
4. Price changes
   a. Long-time trends
   b. Cyclical
   c. Seasonal variations

Division V. Futures Trading

Unit of Instruction

1. History of futures trading
2. Why futures trading developed
3. Economic function of futures trading
4. Regulation of futures trading
   a. Exchange rules and regulations
   b. The commodity exchange authority
5. The role of the price speculator
6. Relationship of cash and futures prices
7. Futures trading concepts
   a. A futures contract
   b. Hedging
   c. Cash basis
   d. Futures delivery
   e. Futures carrying charges
   f. Inverse carrying charges
   g. Spreading
   h. Margins
8. The use of futures markets by marketing firms
   a. Assistance in financing stocks
   b. Protection against price change
   c. Earning of carrying charges
   d. Effect of futures markets on farm prices

Division VI. International Marketing Barriers

Unit of Instruction

1. Principle of comparative advantage
2. Trade restrictions
   a. Tariffs
   b. Quotas
   c. Subsidies
   d. Non-tariff barriers

Division VII. Vertical Integration in Agricultural Marketing

Unit of Instruction

1. Reasons for vertical integration
2. Nature of integrated operations
3. Degree of integration in agriculture in the United States

TEXTS AND REFERENCES

Ayre, *Effects of State and Local Regulations on Interstate Movement of Agricultural Products by Highway.*

Bowring, Southworth, and Waugh, *Marketing Policies for Agriculture.*

Brown, *Increasing World Food Output: Problems and Prospects.*

———, *Man, Land and Food.*

Chicago Board of Trade, "Hedging Symposium for Country Grain Elevator Operators," *Symposium Proceedings.*

———, *Steer Carcass Beef Futures.*

Clark, Tousley, and Clark, *Principles of Marketing.*

Corley, *Grain Transportation in the Northwest.*

Crisp, *Marketing Research.*

Erdman, "Problems in Establishing Grades for Farm Products," *Journal of Farm Economics.*

Frederick, *Using Public Warehouses.*

Hieronymus, *Uses of Grain Futures Markets in the Farm Business.*

Highsmith and Jensen, *Geography of Commodity Production.*

Hunter, *Cost of Operating Exempt For Hire Motor Carriers of Agricultural Commodities.*

Kohls, *Marketing of Agricultural Products.*

Larson, *Agricultural Marketing.*

Locklin, *Economics of Transportation.*

Mackie, *Foreign Economic Growth and Market Potentials for U.S. Agricultural Products.*

Mortenson, *Modern Marketing of Farm Products.*

New York Clearing House Association, *Warehouse Receipt Financing.*

Phillips, *The Economics of Regulation.*

Phillips, *Feed Industry Financing and Contract Programs in Iowa and Surrounding States.*

Roy, *Contract Farming, U. S. A.*

Shepherd, *Marketing Farm Products: Economic Analysis.*

Snowden and Donahoo, *Profitable Agricultural Marketing.*

Sorenson, *Agriculture Market Analysis.*

Soule, Taber, and Kirkwood, *Vertical Integration in the Broiler Industry on the Delmarva Peninsula and Its Effect on Small Business.*

Thompson, *Transportation of Poultry Feed Ingredients from the North Central States.*

Thomsen, *Agricultural Marketing.*

Thomsen and Foote, *Agricultural Prices.*

U.S. Department of Agriculture, *Contract Farming and Vertical Integration in Agriculture.*

———, Economic Research Service, *Changes in Agriculture in Twenty-Six Developing Nations, 1948–1963.*

———, ———, "Grain Marketing—A General Description."

Waite and Trelogan, *Agriculture Market Prices.*

Waugh, *Readings on Agricultural Marketing.*

Wilcox and Cochrane, *Economics of American Agriculture.*

Working, *Price Effects of Futures Trading.*

VISUAL AIDS

Films

Chicago Board of Trade, 131 West Jackson Boulevard, Chicago, Ill. 60604.

After the Harvest. 27 min., 16 mm., color, sound.

Millers National Federation, 309 West Jackson Boulevard, Chicago, Ill. 60606.

Wheat—Food for the World. 28 min., 16 mm., color, sound.

Minneapolis Grain Exchange, 150 Grain Exchange Building, Minneapolis, Minn. 55415.

Grain Exchange—Instrument of Freedom. 25 min., 16 mm., color, sound.

National Education Television Film Service, Audio-Visual Center, Indiana University, Bloomington, Ind. 47401.

The Role of the Market. 30 min., 16 mm., black and white, sound.

Sterling Movies, USA, 43 West 61st Street, New York, N.Y. 10023.

Marketplace, U. S. A. 20 min., 16 mm., black and white, sound.

The Speculator. 30 min., 16 mm., color, sound.

Filmstrips and Slides

Chicago Board of Trade, 131 West Jackson Boulevard, Chicago, Ill. 60604.

Hedging. 22 frames, 35 mm., color.

Business Law

HOURS REQUIRED

Class, 3.

COURSE DESCRIPTION

This course is designed to develop an understanding of the principles of business law as they apply to the grain, feed, seed, and farm supply industry. Employees in a farm supply center need to understand the responsibility they have for meeting the requirements of the law so far as the business is concerned. They must also be aware of the nature of contracts and negotiable instruments. Questions of public liability and of product liability are important to the business and to each employee.

The course is planned to teach students the basic fundamentals of legal responsibility and is not intended to prepare them as expert legal advisors. It is suggested that resource persons be used to assist in many aspects of the course. Representatives of local grain, feed, seed, and farm supply businesses may be invited to discuss specific aspects of business law with the students. Members of the legal profession may be called upon to assist the class with appropriate questions; and other business and professional persons may assist with problems with which they are particularly familiar.

The business law aspects of employee relations and of Federal and State regulations regarding the industry are also important parts of the course. Students may review the literature which is available for these units. Resource persons may also be available to work with them on specific problems.

The instructor should make full use of materials from his State regulatory agencies, and he should be sure that material on Federal regulations is kept up-to-date.

MAJOR DIVISIONS

	Class Hours
I. Importance of Business Law	3
II. Contracts	6
III. Negotiable Instruments	8
IV. Public Liability	10
V. Product Liability	9
VI. Employee Relations	6
VII. Federal and State Laws Regarding the Grain, Feed, Seed, and Farm Supply Business	6
Total hours	48

Division I. Importance of Business Law

Unit of Instruction

1. Responsibility of employees to the firm
   a. Helping the firm comply with regulations
   b. Avoiding acts which would embarrass the firm
2. Responsibilities of the firm to:
   a. Employees
   b. Customers
   c. Business associates
   d. Government

Division II. Contracts

Unit of Instruction

1. Classification of contracts
   a. New elevator construction and remodeling
   b. Formal and simple contracts
   c. Enforcibility—valid, void
   d. Compliance—executed or executory
   e. Reciprocal obligations
2. Essentials of a contract
   a. An agreement, both offer and acceptance
   b. Supported by consideration
   c. Have capacity to contract
   d. Have a legal objective

Division III. Negotiable Instruments

Unit of Instruction

1. The negotiable instruments law (Uniform Act)
2. Types of negotiable instruments
   a. Promissory notes
      (1) mortgage—relation to title
      (2) title-retaining note
      (3) bonds
      (4) collateral
      (5) certificate of deposit
      (6) judgment notes
   b. Bills of exchange (drafts)
      (1) inland bill of exchange
      (2) sight draft and time draft
      (3) trade acceptance
      (4) banker's acceptance

- c. Checks
    - (1) cashier
    - (2) traveler
    - (3) bank draft
- d. Negotiable instruments and negotiable documents distinguished
    - (1) negotiable instruments
        - (a) a form of contract
        - (b) was issued for a consideration
        - (c) may be transferred by negotiation
    - (2) negotiable documents defined
        - (a) bills of lading
        - (b) warehouse receipts
        - (c) some other credit instruments
        - (d) order bill of lading
        - (e) order warehouse receipts

Division IV. Public Liability

Unit of Instruction

Liability for:

- a. Customers' property while at the place of business
- b. Safety of customers while on the premises
- c. Safety of employees
- d. Accident off the premises

Division V. Product Liability

Unit of Instruction

1. For articles sold to customers
    - a. Feeds
    - b. Chemicals
    - c. Fertilizers
    - d. Other products
2. For injury to customers while using articles sold by the firm
3. For loss of production or sales due to products sold to customers

Division VI. Employee Relations

Unit of Instruction

1. Contracts for employment
    - a. Oral contracts
    - b. Written contracts
    - c. Breach of employment contracts
2. Responsibility for acts of employees
    - a. Representation of goods
    - b. Agreement regarding terms of sale
    - c. Agreement regarding extension of credit

Division VII. Federal and State Laws Regarding the Grain, Feed, Seed, and Farm Supply Business

Unit of Instruction

1. Laws governing grain and seed grading
    - a. U.S. Grain Standards Act
    - b. Federal Seed Act
    - c. State laws
2. Laws governing transportation—Interstate Commerce Act
    - a. Interstate and intra-state regulations
    - b. Exempt and non-exempt agricultural products
3. Laws and regulations governing drugs and other contaminants
    - a. Federal Food, Drug, and Cosmetic Act
    - b. State feed laws
4. Laws and regulations governing storage of grains
    - a. U.S. Warehouse Act
    - b. State warehouse laws
5. Laws and regulations pertaining to personnel
    - a. Fair Labor Standards Act
    - b. Social Security Act
    - c. Child Labor Law
    - d. Fair Employment Practices Act

TEXTS AND REFERENCES

Christ, *Fundamental Business Law.*

Fisk and Snapp, *Applied Business Law.*

Houghteling, *The Legal Environment of Business.*

Leavy, *Law for the Small Business Man.*

Weissman, *Law in a Business Society,*

Wilcox, *Caution in Using Feed Additives for Swine.*

Wyatt and Wyatt, *Business Law, Principles and Practices.*

Communications I: Written, Graphic

HOURS REQUIRED

Class, 3; Laboratory, 2.

COURSE DESCRIPTION

Problems of communication plague many individuals and staffs in business and industry. This course is designed to help alleviate the communications problem in the grain, feed, seed, and farm supply industry so far as written communication is concerned. *Communications II,* offered in the second semester, will emphasize oral communication.

Communications I is organized with 3 hours of class and 2 hours of laboratory a week. The class hours will emphasize writing techniques; the organization and presentation of written materials; and the fundamentals of sentence structure, grammar, and spelling which are necessary for proficiency. The laboratory hours will be used for instruction and practice in preparing graphic materials for use in illustrating the written text.

While an ideal situation would be for an individual well qualified in the written and graphic portions of the course to serve as the instructor, it is more likely that two individuals, each qualified in one aspect of the course content, will be needed. Course material must be coordinated and integrated for students.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Personal Communication in Business	3	2
II. Preparation of Written Reports	14	14
III. Preparation of Letters to Customers	3	0
IV. Preparing Advertisements	6	4
V. Preparing News Releases	12	2
VI. Preparing Radio and TV Scripts	10	10
Total hours	48	32

Division I. Personal Communication in Business

A. Unit of Instruction
  1. Records to be kept by individuals
    a. Record of activities: time clock, travel, expenses, personal data, sales
    b. Organization of individual records
  2. Personnel records
    a. Wage
    b. Sick leave, accident
    c. Employment

B. Laboratory Projects
  1. Examine types of records which may be kept by individuals in relation to their job in a business. Make a list of the items best reported in a narrative form and those best reported in a tabular form.
  2. Prepare a form on which to record the activities of employees of a farm supply center that can best be reported in tabular form. As this form is developed, give special consideration to:
    a. Lettering, spacing, and ease of interpreting the information
    b. Kinds of information which can be recorded in tabular form

Division II. Preparation of Written Reports

A. Unit of Instruction
  1. Kinds of reports
    a. Research
    b. Sales
    c. Reports of interviews with customers
    d. Reports by secretaries of meetings
  2. Planning the report
    a. Purpose of the report
    b. Organization
    c. Writing and illustrating the report
    d. Conclusions and recommendations
  3. Use of dictating equipment
  4. Preparing and using sketches, diagrams, pictures, graphs, and tables in reports

B. Laboratory Projects
  1. Secure a copy of at least three kinds of written reports related to the grain, feed, seed, and farm supply industry. These may be research reports, sales reports, reports of interviews with customers, or other kinds of reports related to the industry. Reports should be selected which might be made more attractive by the addition of illustrative materials.

Prepare illustrations for each kind of report. Examples might be: the use of graphs in a research report, the use of cartoons in a report of an interview with a customer, or the use of tables in presenting the results of sales work. Emphasis should be given by the instructor and students to the selection of appropriate media and to techniques of preparation as these activities are being carried out. This will include attention to the selection and construction of graphs, tables of data, pictures, cartoons, sketches, and line drawings.

2. Technicians are often called upon to take minutes of meetings, particularly those conducted according to parliamentary procedure. Each student may attend a meeting and take minutes as if he were the secretary. These minutes should include the material normally required in minutes of meetings conducted according to parliamentary procedure.

Division III. Preparation of Letters to Customers

Unit of Instruction
1. Purposes
    a. Inform about a product
    b. Personal business letters
    c. Service to customer
2. Organization of the letter
3. Spelling, grammar, punctuation

Division IV. Preparing Advertisements

A. Unit of Instruction
    1. Kinds of written advertisements
        a. Classified
        b. Program activities
        c. Handbills
        d. Displays in newpsapers
        e. Posters

B. Laboratory Projects
    1. Collect samples of different kinds of advertisements and mount these in a notebook. Classify the advertisements by types. Prepare a written report describing each type of advertisement and explain where each type is used, estimating its effectiveness.
    2. Select one of the advertisements from the collection and demonstrate how the design of the advertisement could be adapted for advertising a product sold in a local farm supply center.
    3. Prepare a layout for a poster advertisement, including the lettering, the sketches, and other material to be included in the poster.

Division V. Preparing News Releases

A. Unit of Instruction
    1. What makes news material
        a. Timeliness
        b. Reader interest
    2. Characteristics of a news release
        a. Who, what, why, where, when, how
        b. Kinds of releases
    3. Pictures to accompany news releases

B. Laboratory Projects

Cover a news event and take photographs to suit the point of view of the story. For example, if people are to be featured, their photographs should be taken. If a process or practice in agriculture is to be featured, the pictures should emphasize it.

Division VI. Preparing Radio and TV Scripts

A. Unit of Instruction
    1. Radio scripts
        a. Selecting suitable topics
        b. Preparing the script
    2. TV scripts
        a. Selecting the subject
        b. Developing the audio
        c. Developing the visuals

B. Laboratory Projects

Select a topic to be developed and presented via TV. Prepare the audio portion of the script and prepare and collect visual materials such as specimens, charts, posters, objects, and pictures to be used in the presentation. The program may then be presented before the class, with the student using his illustrative materials along with his written script. Since the emphasis in this course is on the preparation of written materials and the illustrative materials to accompany them, the suggestions offered by class members should center primarily around these aspects of the presentation.

TEXTS AND REFERENCES

Arkin and Colton, *Graphs; How To Make and Use Them.*

Aurner, *Effective English for Business.*

DeJen, *Visual Presentation Handbook for Business and Industry.*

Friend and Hefter, *Graphic Design.*

Herold, *ATA Advertising Production Handbook.*

Longyear, *Type Specimens for Layout, Printing and Lettering.*

Lutz, *Graphic Presentation Simplified.*

Maurello, *How To Do Pasteups and Mechanicals: The Preparation of Art for Reproduction.*

Redfield, *Communication in Management: The Theory and Practice of Administrative Communication.*

Rogers, *Graphic Charts Handbook.*

Taylor, *An Introduction to Cartooning.*

United States Government Correspondence Manual.

United States Government Correspondence Manual, Part I, Preparation of Correspondence.

United States Government Correspondence Manual, Part II, Style Practices.

United States Government Correspondence Manual, Part III, Preparation of Special Documents.

VISUAL AIDS

Films

Encyclopaedia Britannica Films, 1150 West Wilmette Avenue, Wilmette, Ill. 60091.

Making Yourself Understood: Introduction to Communication. 14 min., 16 mm., black and white, sound.

Purdue University, Audio-Visual Center, Lafayette, Ind. 47907.

Capital Letters. 21 min., 16 mm., black and white, sound.

Filmstrips and Slides

Jam Handy Organization, 2821 E. Grand Boulevard, Detroit, Mich. 48211.

Capital Letters. 21 frames, 35 mm., color, silent.

Communications II: Oral, Illustrated

HOURS REQUIRED

Class, 3; Laboratory, 2. Prerequisite: *Communications I: Written, Graphic.*

COURSE DESCRIPTION

This is the second semester of a sequence dealing with communications. In this semester, emphasis will be placed on the development of abilities in oral communication, together with preparation and use of materials to illustrate oral presentations.

Laboratory sessions will provide students an opportunity to develop visual materials for use with oral presentations. These will include charts, posters, models, specimens, slides, motion pictures, still pictures, and transparencies.

The class sessions will be devoted to preparation of oral communications, techniques of oral presentation, and the development of principles and practices appropriate for prospective employees in the industry.

In this semester, as in the previous one, it may be desirable to assign one instructor for the laboratory periods and another for the class periods. The laboratory periods may be devoted largely to projects illustrating the presentations. This will require a teacher skilled in preparation of visual materials and in using these materials to emphasize the major points to be orally presented.

If two instructors are used for this program, it must be emphasized that coordination of the work of the class and laboratory is essential.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Conversation in Small Groups	12	8
II. Public Speaking	12	8
III. Oral Communication in the Business	10	6
IV. Identifying Needs and Opportunities for Oral Communication	8	4
V. Visual Communication	6	6
Total hours	48	32

Division I. Conversation in Small Groups

A. Unit of Instruction
  1. Leading the conversation to a subject
  2. How to carry on a conversation
  3. How to involve all participants
  4. How to be a good listener
  5. Conversation in staff committees
  6. Conversation in community service committees

B. Laboratory Projects
  1. Prepare a device to illustrate how conversation may be directed among individuals in small groups. For example, place the group in a circle and toss a ball among the individuals or illustrate the process by means of a chart. Use your initiative to invent a means of illustrating the principle involved.
  2. Choose a topic for a committee discussion. Prepare material to illustrate the points you want to make in the presentation. Keep in mind the kind of group in which you are participating so that the material will be appropriate for the occasion.

Division II. Public Speaking

A. Unit of Instruction
  1. Assuring effective:
     a. Composition
     b. Delivery
     c. Use of visual materials

B. Laboratory Projects
  1. Each student may select a topic appropriate for an employee of a local farm supply center to present at a community meeting of farmers. The talk may be outlined, and the student may then prepare the visual materials to accompany the talk. These may be charts, slides, or overhead transparencies. The talk may be given before the class. Class members should have the opportunity to suggest improvements.
  2. Select an appropriate seasonal topic for a TV presentation. Prepare the script, including the audio and visual portions of the presentation. Confer with a program director of the local TV station to find out the colors that can best be used for visual materials on TV. With this in

mind, prepare a set of charts to illustrate the TV program. Present the program in the class. Invite representative farmers and businessmen as guests. Solicit comments and criticisms. If it is appropriate and desirable in the community, students may conduct a contest. The two or three best programs may be presented over a local TV station by one of the farm supply centers.

Division III. Oral Communication in the Business

A. Unit of Instruction
   1. Clinics with customers
   2. Clinics with staff members
   3. Sales meetings
   4. Demonstrations
   5. Conducting a business meeting using proper parliamentary procedure
   6. Using the telephone for business transactions

B. Laboratory Projects
   1. Select a timely subject dealing with the promotion of an appropriate product sold by a farm supply center in the area. Prepare a script and set of slides which might be used by the local business in the promotion of the product. Record your oral presentation on a tape recorder and present the program to the class for criticism.
   2. The teacher divides the class into groups of two or three. Each group may prepare a demonstration of a process or a practice which is appropriate for the area. The demonstration will involve both explanation and doing. Ask the class members to criticize the presentation.
   3. Take a field trip to observe demonstration plots of crops or fertilizer or feeding trials with livestock. Prepare a visual presentation of the demonstration to be given to groups which did not have an opportunity for first-hand observation.
   4. Each student may be called upon to conduct a piece of business following approved parliamentary procedure. The items of business may be assigned and the meeting may be conducted to demonstrate correct parliamentary procedure.
   5. Students may be assigned in pairs to demonstrate acceptable telephone courtesy. Demonstration suggestions:
      a. The sale and purchase of a carload of grain by telephone. Demonstrate an acceptable method or an undesirable form by confusing the terms, being indefinite, or by being incomplete in terms of the agreement.
      b. How the farm center employee would respond to a customer who is displeased and angry about a transaction or a service.
      c. How a salesman might service a customer who calls in an order.

Division IV. Identifying Needs and Opportunities for Oral Communication

A. Unit of Instruction
   1. Means of informing customers
      a. Announcement of new products
      b. Success stories
      c. Market news
      d. Research reports
      e. Demonstrations

B. Laboratory Projects
   1. Obtain a report of research in agriculture or in agricultural business. Prepare an illustrated talk for the employees of the local farm supply centers explicating the results of the research and interpreting them in terms of their effect on local business.
   2. Study the most recent market news reports which are applicable to the area. Prepare a large chart which will interpret the findings for the customers of a local farm supply center. Present the chart before the class with an explanation of the conclusions. Afterwards, the chart may be offered to the local farm supply center for use in the sales room.

Division V. Visual Communication

A. Unit of Instruction
   1. Use of the camera to obtain pictures for:
      a. Printing
      b. Television
      c. Group meetings
   2. Use of projection equipment
      a. Motion picture

b. Slide projector

c. Overhead projector

B. Laboratory Projects

Note: The following projects may be used to complete the laboratory projects suggested in Division III, Section B, No. 3.

1. Secure a camera, either through the school or through your own resources, and learn how to use it. Take one or more black and white pictures. These may be of your own choosing or they may be specifically assigned in terms of subject and purpose. Display the prints, and invite a resource person in the community to evaluate the pictures in terms of the assignment.
2. As a member of a committee of two or three students take color slides or movies to fit a planned script. The class may review and evaluate their effectiveness for the purpose assigned.
3. Prepare materials and make overhead transparencies to illustrate a prepared talk. Transparencies may be produced by any of the standard equipment available at the school.

TEXTS AND REFERENCES

Bender, Clark, and Taylor, *The FFA and You.*

DeJen, *Visual Presentation Handbook for Business and Industry.*

Dooher and Marquis, *Effective Communication on the Job; A Guide to Employee Communication for Supervisors and Executives.*

Hartsell and Veenendaal, *Overhead Projection.*

Hoffman, *Public Speaking for Business Men.*

Kemp, *Planning and Producing Audio-Visual Materials.*

Micken, *Speaking for Results: A Guide for Business and Professional Speakers.*

Reager, *You Can Talk Well.*

Robert, *Robert's Rules of Order.*

Rogers, *Graphic Charts Handbook.*

Strauss and Strauss, *New Ways to Better Meetings.*

Thomas and Swarthout, *Integrated Teaching Materials: How To Choose, Create and Use Them.*

VISUAL AIDS

Films

American Telephone and Telegraph Company, 195 Broadway, New York, N.Y. 10007.

Manner of Speaking. 28 min., 16 mm., color, sound.

Telephone Courtesy. 25 min., 16 mm., black and white, sound.

Coronet Instructional Films, 65 East South Water Street, Chicago, Ill. 60601.

Improve Your Pronunciation. 11 min., 16 mm., color, sound.

Listening Skills: An Introduction. 11 min., 16 mm., color, sound.

Parliamentary Procedure in Action. 13 min., 16 mm., black and white, sound.

Ways to Better Conversation. 10 min., 16 mm., color, sound.

Encyclopaedia Britannica Films, 1150 West Wilmette Avenue, Wilmette, Ill. 60091.

How To Conduct a Discussion. 22 min., 16 mm., black and white, sound.

Making Yourself Understood: Introduction to Communications. 14 min., 16 mm., black and white, sound.

Mr. Chairman: The Fundamentals of Parliamentary Law. 13 min., 16 mm., black and white, sound.

International Film Bureau, 332 South Michigan Avenue, Chicago, Ill. 60604.

Facts About Projection. 17 min., 16 mm., color, sound.

Round Table Productions, 321 South Beverley Drive, Beverley Hills, Calif. 90212.

Engineering of Agreement. 28 min., 16 mm., black and white, sound.

Filmstrips and Slides

Association of American Railroads, 815 – 17th Street, N.W., Washington, D.C. 20006.

Railroads and Communication. 36 frames, 35 mm., color, silent. Eastman Kodak Company, Rochester, N.Y. 14604.

About Cameras. Forty-seven 2 x 2 slides, 35 mm., color.

Hold the Camera Steady. Thirty 2 x 2 slides, 35 mm., color.

Take Good Pictures. Sixty-seven 2 x 2 slides, 35 mm., color.

Things Inside and Outside Your Camera. Sixty-one 2 x 2 slides, 35 mm., color.

Which Pictures Are Good Pictures? Twenty-eight 2 x 2 slides, 35 mm., color.

U.S. Department of Agriculture, Office of Information Services, Washington, D.C. 20250.

Effective Use of Visuals in Agriculture. 16 frames, 35 mm., color, silent.

TAPES

Paul S. Amidon and Associates, Minneapolis, Minn. 55402.

Each tape is 15 minutes in duration and is accompanied by student response booklets and charts.

"Attentive Listening"
"Critical Listening"
"Deductive Listening"
"Evaluative Listening"
"Keeping Your Listening Alive"
"Perceptive Listening"
"Purposeful Listening"
"Retentive Listening"
"Stabilization of Listening Skills"
"What Is Listening?"

Salesmanship

HOURS REQUIRED

Class, 1; Laboratory, 6.

COURSE DESCRIPTION

The course is designed to teach retail and service salesmanship to students. The purposes of selling and the qualities needed by an individual are discussed briefly, including the necessity of knowing the product, the contribution of the salesman to the firm, and the sources of information available to the salesman. While it is important for the student to understand these aspects of sales work, by far the greatest amount of course time should be spent in learning the characteristics of customers and in learning and practicing actual sales techniques. It is vital for the outside salesman to have completed a technician program related to the products he is to sell to be expert as a salesman.

The job of the inside salesman is no less important to the success of the business. He too must be an expert technician as well as an expert sales and service man as he serves his customers. Role playing is one of the most satisfactory methods of teaching salesmanship. Students may work in pairs alternating as customer and salesman. Assign problems such as product to be sold and characteristics of the customer. The salesman must demonstrate all of the steps in selling, including the pre-approach, the approach, getting attention, getting the interest of the customer, explaining how the product will benefit the customer, giving the customer assurance, and closing the sale.

The course has been outlined and the time has been allocated for individual units so as to provide all the time possible to practice salesmanship. Provision for as many opportunities as possible to demonstrate before the class is necessary. The instructor may wish to limit each presentation to allow ample time for discussion of the presentation.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Purpose of Selling	1	0
II. The Salesman	1	2
III. Sales Promotion and Advertising Helps for the Salesman	1	2
IV. Locating and Qualifying Prospects	1	8
V. Customers: Their Needs and Wants	1	12
VI. Steps in Making a Sale	11	72
Total hours	16	96

Division I. Purpose of Selling

Unit of Instruction

1. Vital to the success of the business
2. Service to the customer and to the community

Division II. The Salesman

A. Unit of Instruction
   1. Essential traits needed by a salesman
      a. Character
      b. Human qualities
      c. Mental qualities
      d. Appearance
      e. Maturity
   2. Contribution of the salesman to the business
      a. Improving profits
      b. Increasing sales
      c. Holding present customers
      d. Securing new customers
      e. Building store traffic
      f. Encouraging broader product use
      g. Credit and collection assistance
      h. Building good will
      i. Inventory control
      j. Assuring steady profit and work
   3. Knowing the merchandise
      a. What to know
         (1) background of firm making the product
         (2) company policies related to selling
         (3) product history
         (4) development of the product
         (5) product performance
         (6) the competition
      b. Sources of information
         (1) training programs
         (2) trade magazines, catalogs, and manuals
         (3) business and technical publications

        - (4) industry research
        - (5) research by experiment stations and research centers
        - (6) experiences of customers
        - (7) competitive publications and reports

B. Laboratory Projects

The teacher assigns pairs of students to demonstrate specific qualities of a salesman. One member may serve in the role of the customer and the other may serve in the role of the salesman. The teacher assigns pairs to demonstrate different characteristics. They demonstrate correct and incorrect techniques such as good versus poor grooming and poor product knowledge versus excellent product knowledge.

Division III. Sales Promotion and Advertising Helps for the Salesman

A. Unit of Instruction

1. How advertising and promotion help the salesman
2. How advertising helps the customer
3. Coordinating advertising and sales promotion with the sales presentation. (Also see units in *Communications I* and *II* and *Retail Farm Supply Merchandising.*)

B. Laboratory Projects

Prepare a suggested advertisement for feed, fertilizer, or some other product commonly sold at the farm supply center to run in the local newspaper. Prepare a sales presentation to show how the advertisement is used to help with the sale.

Division IV. Locating and Qualifying Prospects

A. Unit of Instruction

1. Locating prospects
    - a. Personal observation and inquiries
        - (1) using newspapers to discover names of prospects
        - (2) observation of farms in the territory
        - (3) records of calls at the farm supply store
        - (4) inquiries to identify outstanding farmers, feeders, and grain and feed producers
    - b. Contacts in the community
        - (1) social contacts
        - (2) service clubs
        - (3) other community organizations and activities
        - (4) names of prospects from those called upon
    - c. Influential people in the community
    - d. Cold canvass
2. Qualifying prospects
    - a. Authority to buy
    - b. Financial capacity
    - c. Satisfactory credit rating

B. Laboratory Projects

1. In groups of two to four, attend specific community meetings for the purpose of compiling a list of prospective customers for a farm supply center. Assume the roles of salesmen, discovering potential customers without divulging the purpose.

    Upon returning to the laboratory, each student reports the experience and presents a list of prospects, giving pertinent data about each.

2. Examine newspapers covering the area served by the school and list prospective customers for the farm supply center which may be gleaned from the papers.

    Write plans for contacting these prospects, explaining the method of making the contacts and presenting the material to be used. For example, if plans are to send letters, include a sample letter; if plans are to use the telephone, include a plan for what will be said. If the plan includes other methods, be sure to describe these in detail. A committee of students may select from the plans a number which may be demonstrated for the class by means of role-playing techniques.

Division V. Customers: Their Needs and Wants

A. Unit of Instruction

1. Product benefits
2. Primary, selective, and patronage motives
3. Rational versus emotional motives
4. Basic motivations
    - a. Profit
    - b. Safety
    - c. Ease and convenience
    - d. Performance and durability

B. Laboratory Projects
  1. Select a list of items commonly sold in a farm supply center in the locality. Indicate for each item the motive which would dominate in causing a customer to purchase the item. If you believe that different individuals would act from different motives, indicate the motives; and write a description of the differences in the individuals being considered.
  2. Visit a local store. Without interfering, try to identify and record the motives that prompted customers to buy.
  3. Prepare a demonstration to show how to appeal to a customer who would be motivated by the "ease and convenience" motive, the "safety" motive, or the "profit" motive.

Division VI. Steps in Making a Sale

A. Unit of Instruction
  1. Obtaining information concerning the customer
    a. Kind of information needed
      (1) kind of business
      (2) size of business
      (3) condition of business activity
      (4) income of the customer
      (5) sources of income
      (6) family
      (7) owner, tenant, landlord
      (8) community organization membership
      (9) fraternal affiliations
      (10) ambitions
      (11) accomplishments
    b. Sources of information
      (1) records of the firm
      (2) other salesmen
      (3) county courthouse
      (4) local editor, banker, barber, credit bureau
  2. Getting the attention of the customer
    a. Establishing a friendly relationship
    b. Showing interest in the prospect
    c. Being complimentary
    d. Learning additional information to help make a better presentation
  3. Interesting the customer
    a. Conversation on things of interest to buyer
    b. Using samples of the product
    c. Using results of demonstrations, research, and experience
  4. Explaining how the product will benefit the customer and appeal to his motives
  5. Providing examples of:
    a. Successes others have had with the product
    b. Tests, demonstrations, or research
  6. Closing the sale—suggesting:
    a. Volume purchase
    b. Immediate delivery
    c. Starting the benefits at once
  7. Inside versus outside selling
    a. Importance of each
    b. Opportunity to practice the steps in selling
      (1) number of items to sell; outside salesman is limited in number of items he can carry
      (2) volume of product to sell; volume is not limited for either; outside salesmen usually are attempting to sell more of one item
      (3) service aspects of outside selling versus inside selling
        (a) sales routes
        (b) servicemen representing the firm

B. Laboratory Projects
  1. Select one or more potential customers in the territory and record the information necessary for planning an effective sales approach.
  2. Identify the characteristics of the potential customer on which a salesman could capitalize in making a sales approach. Prepare a brief analysis of the customer and explain why the product could be sold to him.
  3. Using another student in the class, demonstrate how to proceed in gathering information about a potential customer from the people of his community. Ask the class to criticize the procedures.
  4. Use the steps in making a sale indicated in the course outline. In cooperation with another class member, prepare a role-playing demonstration in which one acts as the salesman and demonstrates a

"method of getting the attention of a customer." Various demonstrations may be used to show different techniques. The demonstrations would be performed before the class; class members may be asked to criticize. Repeat for each of the steps in making a sale.

5. Visit local stores as a customer and observe the techniques of the sales personnel. Develop a list of responses a sales person might make (such as thanking the customer) and check the list after leaving the store. The teacher should make a composite list when all the students have completed the activity.
6. In cooperation with another student prepare and demonstrate the sale of a product. Class members may observe and offer criticisms and suggestions. Repeat many times using a variety of presentations and methods, and with the "customer" playing the role of a different kind of individual in each case. The "customer" may assume increasingly difficult roles so that the salesman will be challenged to solve increasingly difficult problems.
7. A variation of the role playing may be for the instructor or a resource person from a local business to play the role of the customer and to offer suggestions at the close of the demonstration.
8. The teacher continues the role-playing procedure by assigning a problem to each pair of students. One student may assume the role of a farmer and the other that of an outside salesman.

   It is suggested that assignments be hypothetical in terms of association with any local individuals, but real in terms of the problems presented. An example might be to sell a contract to furnish feed to a large cattle feeder in the area. The cattle feeder may be described as a progressive feeder but suspicious of salesmen and of the quality of their products. Other problems suited to the area of the school may be developed. In addition, other types of potential customers may be described by the teacher so that students may have an opportunity to practice sales presentations adapted to many different kinds of customers.
9. After each demonstration, the students write an analysis of the sales presentation and offer suggestions for improvement.
10. Using the data obtained about potential customers in the market survey conducted in the course *Retail Farm Supply Merchandising,* prepare a sales presentation, present it to the class, and assume a sale has been completed. Write the kind of report a salesman would make to his store manager, showing the results of the sale and any other information that might be useful in making future sales.

TEXTS AND REFERENCES

Alexander, *Direct Salesman's Handbook.*

Arnet, *How To Develop a Million Dollar Sales Presentation.*

Buskirk and Buskirk, *Management of the Sales Force.*

Canfield, *Salesmanship, Practices and Problems.*

Greif, *Modern Salesmanship.*

Haas and Perry, *Sales Horizons.*

Logan, *Training Retail Salespeople.*

Russell, Beach, and Buskirk, *Textbook of Salesmanship.*

Stolte, "Introduction to Feed Sales-Man-Ship," *Feed and Feeding Digest.*

———, "Overcoming Objections to Selling Feed," *Feed and Feeding Digest.*

Sutton, *The Technique of Selling.*

U.S. Department of Commerce, Bureau of the Census, *United States Census of Agriculture; Farms, Farm Characteristics, Farm Products.*

U.S. Small Business Administration, "Managing to Sell," *Administrative Management Course Program.*

Whiting, *The Five Great Problems of Salesmen and How To Solve Them.*

Wingate and Nolan, *Fundamentals of Selling.*

VISUAL AIDS

Films

Encyclopaedia Britannica Films, 1150 West Wilmette Avenue, Wilmette, Ill. 60091.

The Importance of Selling. 19 min., 16 mm., black and white, sound.

Seminar: Personal Relationships, Personal Finances, and Management

HOURS REQUIRED

Class, 2; Laboratory, 2. Prerequisite: *Communications II: Oral, Illustrated; Agricultural Economics and Marketing.*

COURSE DESCRIPTION

This seminar is designed to assist the student in applying for a job and to provide understanding of basic economic principles related to his personal finances as he enters the working force. It is suggested that students be given an opportunity to prepare application forms and letters of application for positions. Also, they may examine copies of applications of others and evaluate them. In the latter case, the identity of the applicant may be concealed. The forms may be examined by means of a projector or by giving copies to each student. Letters of application may be prepared and studied in a similar manner.

Interviews may be demonstrated by a role-playing procedure, using prospective employers or others to interview students in front of the class. Reports of experiences of students who have had interviews may also be included.

The period just prior to securing the first job is an appropriate time for students to learn some of the basic principles of economics and how to apply them in their personal lives. For this purpose, students may study principles and, in the laboratory periods, prepare budgets, plan investments and savings, learn to analyze and compute the cost of credit, and the like.

MAJOR DIVISIONS

	Hours	
	Class	*Laboratory*
I. Getting a Job	4	10
II. Functions of Supervision	4	0
III. Functions of Employees	3	6
IV. In-Service Training of Employees	3	0
V. Customer Relations	4	0
VI. Personal Income Management	6	8
VII. Insurance, Personal Investments, and Social Security	8	8
Total hours	32	32

Division I. Getting a Job

A. Unit of Instruction

1. What employers want
   a. Desirable attitude toward the job
      (1) willingness to work
      (2) ability to get along with others (human relations)
      (3) characteristics of leadership
      (4) teamwork
   b. Ability necessary to do the job
      (1) carry out the policies of the firm
      (2) follow the best safety practice at all times
      (3) project the best possible image of the firm
   c. Adequate training for the job
      (1) competent for the present job
      (2) ability and willingness to progress through:
         (a) further training for promotion
         (b) retraining to keep abreast of new technology
2. Applying for the job
   a. Types of interviews
   b. Preparing and presenting credentials
      (1) personal data: name, address, age, marital status, health, military service
      (2) education: schools attended, major courses
      (3) work experience: place of employment, kind of work, length of employment
      (4) references
      (5) hobbies
   c. Understanding job descriptions
   d. Writing letters of application

B. Laboratory Projects

1. Cooperate with another student in a role-playing exercise. One student may assume the role of employer; the other that of candidate for a job in the farm supply

store or country elevator. A local manager (or personnel director) may serve as a resource person and demonstrate interview procedures. The instructor or school administrator may play the role of the employer to demonstrate interview procedures.

2. One 2-hour laboratory period may be spent preparing the credentials and applications for a job. If a job description is available, make sure the application is in line with it.
3. If time permits, students may evaluate the written credentials of each other to discover the most acceptable methods of preparing credentials. The documents may be projected on a screen (with names blocked out if desirable).

Division II. Functions of Supervision

Unit of Instruction

1. Techniques of supervision of employees
   - a. Delegation of responsibility and authority
   - b. Accountability of employees
   - c. System of awards
2. Labor-management relations
   - a. Promotion policies
   - b. Worker grievances
   - c. Wages, benefits program
   - d. Legal regulations (wages and hours, child labor, nondiscrimination)

Division III. Functions of Employees

A. Unit of Instruction

1. Responsibility to management to:
   - a. Perform assigned tasks in a satisfactory manner
   - b. Carry out the policy of management
   - c. Do an adequate day's work
   - d. Keep management informed on:
     - (1) working conditions
     - (2) safety conditions
     - (3) condition of product
     - (4) condition of machinery, buildings, and equipment
   - e. Project desirable company image
2. Responsibility for self-improvement
   - a. Aware of need for keeping up-to-date
   - b. Recognizing the need for self-improvement
   - c. Accepting the opportunity for self-improvement
     - (1) self study
     - (2) in-service training

B. Laboratory Projects

The teacher organizes the class into groups of two to four. He assigns each group a different project appropriate to the unit of instruction, or he assigns the same project to all. Examples:

- a. One group may prepare a demonstration to call the manager's attention to an unsafe situation in the plant.
- b. Another group might demonstrate selected ways of projecting an image of the firm in the community. Included might be:
  - (1) demonstration of proper dress and grooming
  - (2) panel discussion on desirable conduct outside working hours
  - (3) field trip to observe employee activities related to creation of image of the industry

Division IV. In-Service Training of Employees

Unit of Instruction

1. Orientation of new workers to the job
2. Participation in programs for up-dating workers to new:
   - a. Products
   - b. Techniques and equipment
   - c. Uses for a product
   - d. Government regulations and policies
   - e. Economic situations
3. Where to get in-service training
   - a. In-plant training offered by the firm
   - b. Short courses, summer schools, institutes offered by universities and vocational-technical centers
   - c. Adult evening school programs
   - d. Private technical institutions

Division V. Customer Relations

Unit of Instruction

1. Handling customer complaints
2. Serving the customer
3. Neat appearance
4. Product information
5. Neat building and grounds
6. Off-duty responsibility to the firm
7. Other

Division VI. Personal Income Management

A. Unit of Instruction
   1. Consumption—the core of economics
   2. Economics defined
   3. Personal and family budgeting
   4. Analytical buying
      a. Applying quality standards
      b. Consumer's research and similar aids
   5. The use of credit
   6. Housing—own or rent

B. Laboratory Projects
   1. Prepare a personal or family budget in line with anticipated income.
   2. Select an item (car, boat, television), and compute the cost of credit by several methods of financing. Prepare a set of charts for a presentation showing the variation in cost of credit.
   3. Prepare a comparison of two or more similar items in terms of quality and cost. Work in pairs, and set up a display to illustrate advantages of one item over the other.

Division VII. Insurance, Personal Investments, and Social Security

A. Unit of Instruction
   1. Insurance defined
   2. Life insurance
      a. Group, industrial, and ordinary life policies
      b. Types of policies—their advantages and disadvantages
   3. Investments
      a. Savings accounts and government bonds
      b. Corporation bonds
      c. Corporation stocks
      d. Annuities
      e. Pension plans
   4. Social security
      a. Old age and survivors' insurance, medicare
      b. Unemployment compensation

B. Laboratory Projects

Prepare an investment plan to follow in connection with the income from an anticipated job. Include in the plans:
   a. Insurance to carry
   b. Investments—kinds and amounts
   c. Social security benefits anticipated

TEXTS AND REFERENCES

Chruden and Sherman, *Personnel Management.*

Garrett, *Ethics in Business.*

Lyman, *Basic Economic Principles.*

Phillips, *Managing for Greater Returns in the Grain, Feed, and Other Retail Businesses Serving Agriculture.*

Strauss and Sayles, *Personnel.*

U.S. Department of Labor, *Prepare Yourself for Job Interviews.*

VISUAL AIDS

Films

National Safety Council, 425 North Michigan Avenue, Chicago, Ill. 60611.

Down at the Office. 10 min., 16mm., black and white, sound.

Round Table Films, Inc., 321 South Beverley Drive, Beverley Hills, Calif. 90212.

I Just Work Here. 17 min., 16 mm., color or black and white, sound.

Sterling Movies, U.S.A., 375 Park Avenue, New York, N.Y. 10023.

How Stocks Are Bought and Sold. 20 min., 16 mm., black and white, sound.

Sutherland Educational Films, Inc., 201 North Occidental Boulevard, Los Angeles, Calif. 90026.

Personal Financial Planning. 11 min., 16 mm., color, sound.

The Wise Use of Credit. 11 min., 16 mm., color, sound.

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20201.

A Supervisor Takes a Look at His Job. 13 min., 16 mm., black and white, sound.

FACILITIES, EQUIPMENT, AND COSTS

Planning Facilities

Laboratories and related classrooms, offices, and storage facilities required for preparation of technicians for the grain, feed, seed, and farm supply industry do not present special problems.

The laboratories should be on the ground floor to facilitate moving supplies in and out of the building. Hot and cold water, gas, and electric service lines should be planned for the work areas and for the demonstration table in each laboratory. These facilities will be necessary for making the specialized tests of grains, feeds, soils, and fertilizers.

Electric service should be available for motors, ovens, and other equipment in the laboratories. This will require 115 V. and 220 V. service, although the typical farm service center with a grain elevator will also be supplied with 440 V. current. Each laboratory should have a master control panel for the electrical equipment.

The department head or instructor should make final decisions on the choice of laboratory equipment because of his knowledge of technical details. Costly mistakes often result when non-technical personnel attempt to equip a scientific laboratory.

Surplus equipment, from either private or public organizations, can be an important source of good materials and hardware for equipping laboratories. Government surplus property may often be an especially attractive source of either standard or specialized components, units, assemblies, mechanisms, instruments, and systems at a cost which usually is only a small fraction of their cost new. Educational institutions are high on the priority list of agencies to which government surplus property is made available.[1]

Distribution of surplus property within the States must be made through State Agencies for Surplus Property. Most such State Agencies maintain one or more distribution centers at which authorized representatives of eligible schools or school systems select materials for educational use. Usually one or more officials of a school or school system are designated as authorized representatives. Technical educators should communicate with their authorized school or school system representative, if one exists, to arrange to visit their State Agency's distribution center; or write to the Director of their State Agency for Surplus Property to obtain information regarding the procedures to be followed in acquiring equipment.

The State Director of Vocational and Technical education in each State can provide specific information on the location of the government surplus property distributing agency in his State and the persons in charge. Information on government surplus property may also be obtained by writing to:

Chief, Surplus Property Utilization Division
U.S. Department of Health, Education, and
Welfare
Washington, D.C. 20201

It is important to exercise the same elements of judgment and care in acquiring surplus equipment as is used in buying new equipment. Specific plans for the use and sound justification for the need should clearly be established for *any* piece of surplus equipment. A careful analysis should be made of its total effectiveness in the program. Its entire cost, including initial outlay, transportation, installation, repair or tune-up (if incomplete), and maintenance expenses must also be taken into consideration along with the space requirements of the equipment and its pertinence in terms of obsolescence.

Only technically competent, responsible, and imaginative persons should select surplus equipment; and then, only after a thorough on-site inspection. This practice avoids the temptation to acquire attractive but obsolete, irrelevant, bulky, or excessive equipment.

The drawings and layouts which follow are suggested as examples of satisfactory classrooms and laboratories for the program. These laboratories are planned to provide the facilities for the entire program.

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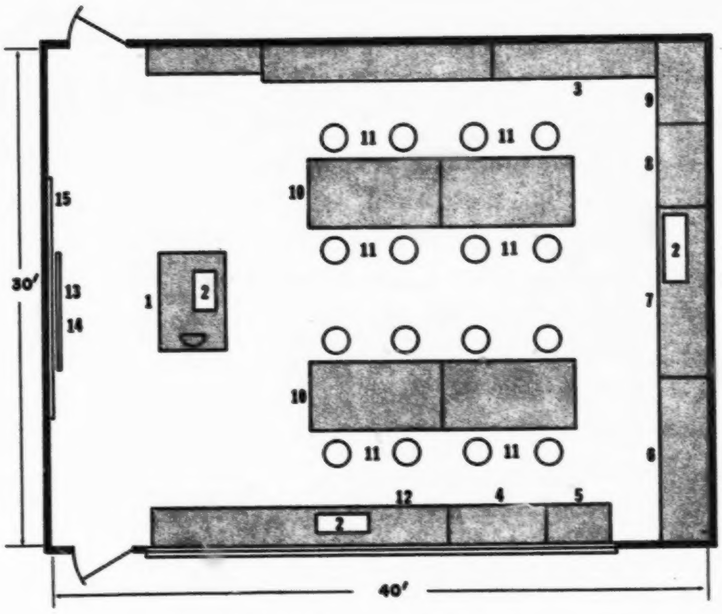
[1] U.S. Department of Health, Education, and Welfare; Office of Field Administration; Division of Surplus Property Utilization. *Directroy: Directors of State Agencies for Surplus Property and Regional Representatives Division of Surplus Property Utilization; Department of Health, Education, and Welfare.* 1965. *How to Acquire Federal Surplus Personal Property for Health, Education, and Civil Defense Purposes and Federal Surplus Real Property for Health and Educational Purposes.* 1965 *Surplus Material and Science Education.* 1964. Washington, D.C. 20402: U.S. Government Printing Office.

KEY LABORATORY LAYOUTS

Agronomy Laboratory

No.	*Item*
1	Demonstration table
2	Sink
3	Growing bench, 2′ x 4′, five shelves high
4	Trip balance
5	Oven
6	Colorimeter or spectrophotometer
7	Atom absorption spectrophotometer
8	pH meter
9	Flame photometer
10	Student tables
11	Student chairs or stools
12	Sample shaker
13	Bulletin board
14	Chalk board
15	Projection screen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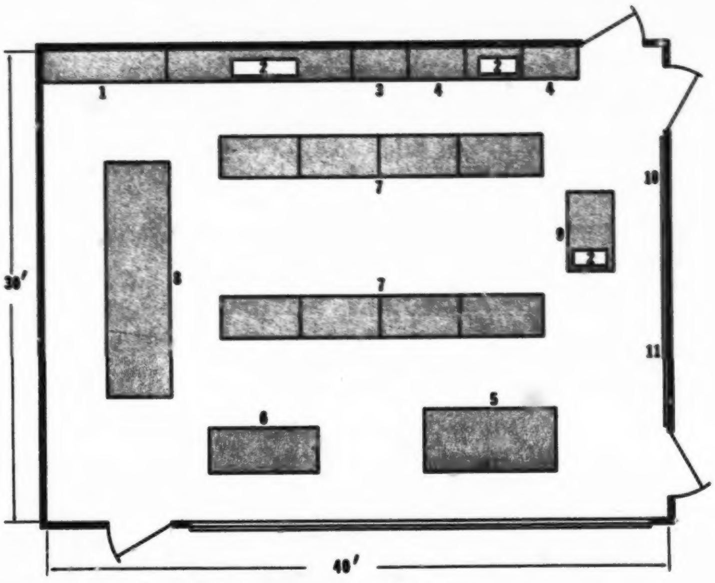
40′

Figure 31.—Agronomy Laboratory.

Feed Laboratory

No.	*Item*
1	Analytical balance, 10½″ x 16½″ x 17½″ high
2	Sink—sizes vary
3	Counter scale, 16″ x 24″
4	Trip balance, approximately 16″ x 10″
5	Feed mixer, approximately 4′ x 4′
6	Seed cleaner, 80″ x 35″ x 51″ high
7	Student tables, 30″ x 60″
8	Small animal cages, six, 22″ x 20″ x 15″ high; twelve, 9″ x 15″ x 9″; Table, 4′ x 16′
9	Demonstration table, 36″ x 60″
10	Chalk board
11	Bulletin board

All outside doors and doors to storage—4 feet wide.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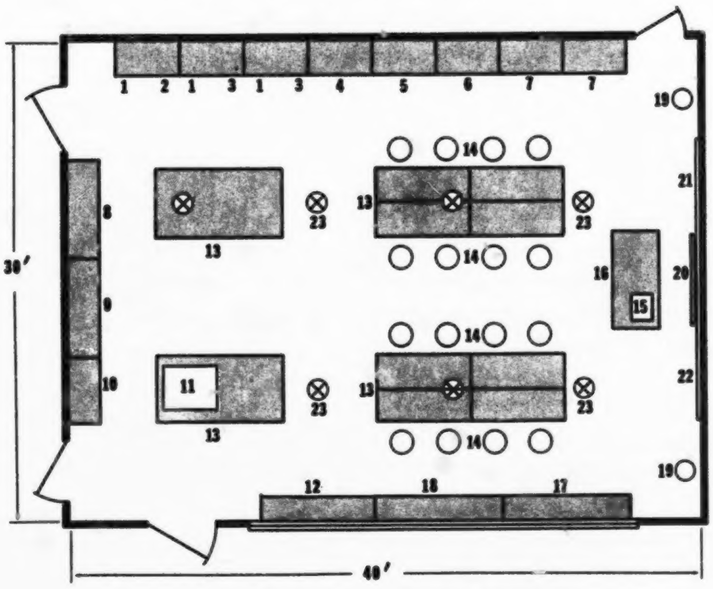
40′

Figure 32.—Feed Laboratory.

Grain and Seed Laboratory

No.	*Item*
1	Grain scales
2	Steinlite moisture tester
3	Motomco moisture tester
4	Boerner weight per bushel tester
5	Weight per bushel tester, hand type
6	Barley pearler
7	Seed sampler
8	Seed germinator
9	Udy protein analyzer
10	Office-size seed cleaner
11	Dockage tester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12
18
17
19
40′

Figure 33.—Grain and Seed Laboratory.

12 Oil and fat tester, Steinlite, 300 L. O. S., 21″ high x 21¾″ long x 9½″ wide
13 Laboratory tables, 60″ x 30″
14 Student chairs or stools
15 Sink
16 Demonstration table, 3′ x 6′ x 36″ high
17 Book shelves
18 Magazine rack
19 Fire extinguisher
20 Bulletin board
21 Chalk board
22 Projection screen
23 Simulation of north sky daylight at 7,400° K.

Laboratory Facilities

The agronomy laboratory provides for work with fertilizers and with plants where plant food deficiencies, response to environmental conditions, and the like can be demonstrated.

The grain and seed laboratory is planned for students to practice grain grading and seed analysis and to conduct other tests related to the grain and seed aspects of the industry.

The seed cleaning equipment is shown in connection with the feed laboratory. This is suggested since it would confine to one laboratory the activities that are likely to be dusty. The use of most of the equipment, however, should be flexible so that it can be moved from one laboratory to another as needed.

The suggested work shelves, located at the sides of the laboratories, with storage space beneath, may be built in or purchased in units from laboratory equipment houses. The relative cost and appropriateness of these alternatives should be determined locally.

It is important to provide for adequate ventilation for the laboratories where chemical fumes are likely to be produced. If it is necessary to provide a biochemistry laboratory for this technician program, ventilating hoods and exhaust fans will be needed.[2]

In the case of the feed laboratory, which includes small animal cages for demonstration and experimental work, it will be advisable to provide ventilation to expel objectionable odors, thereby keeping them out of the remainder of the building. It is suggested that floors and walls of this part of the laboratory consist of materials which are easily kept clean and sanitary. As an alternative to locating the small animal cages in this laboratory, experience has shown that they could also be located in a small, separate building which may also be used for similar work with poultry, swine, calves, or sheep. This building may be a barn which is no longer used on a farm or some other suitable building near the school. Such a facility must, of course, be kept clean and sanitary; its use would keep odors away from the school building.

Office and Storage Space

Office space for instructors, also available for conferences with individual students, should be provided. If the laboratories for this curriculum are arranged in a wing of a school building, office space may be located between two of the laboratories. This is suggested in the sketches of the grain and seed laboratory and the feed laboratory as indicated by the doors at the end of the laboratories. These are arranged either to afford passage between the two laboratories, or to allow access to an office-storeroom area located between the two laboratories.

Planning Equipment

Audio-Visual Equipment

It is important to use the audio-visual materials available from industry, government, and experiment stations in this technician program.

The following equipment should be available for use:

Item	*Approximate cost*
16 mm. sound motion picture projector	$ 700
Slide projector for 2 x 2 slides	125
Projector for 3 x 4 slides	150
Overhead projector	200
Projection screen	100
Tape recorder	200

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[2] For discussion of ventilation in chemical laboratories, see: *Chemical Technology: A Suggested Two-Year Post High School Curriculum* (Technical Education Program Series No. 5). U.S. Department of Health, Education, and Welfare; Office of Education. Washington, D.C. 20402: Superintendent of Documents, U.S. Government Printing Office, 1964.

Additional audio-visual aids are likely to be available in the near future. These will expand the opportunity for use of audio-visual materials. These should be added as they become available and practical. In the case of new construction, laboratories should be equipped for closed-circuit television facilities.

Biochemistry Equipment

It is assumed that the school is already equipped with an adequate biochemistry laboratory to test grains, feeds, and forages for fiber, N-free extract, carbohydrates, fats, and minerals. If this is not the case, school authorities will need to decide whether to purchase and install this additional equipment. It is suggested that this equipment be part of the chemistry department in a community college or vocational-technical program. Equipment and supplies for analyzing samples of grain and feed will include the following:

Item	*Estimated cost*
A balance (scales) with weights for weighing large samples	$ 250
An analytical balance (scales) with weights for weighing precise portions for analysis	500
A mill with accessories for grinding samples finely enough to permit uniform mixing	950
An electrically heated oven with a temperature regulator for determining moisture	300
A twelve-unit apparatus for determining crude fiber	900
A twelve-unit combination digestion and distillation apparatus and accessory equipment for determining crude protein	2,500
An initial supply of necessary chemicals and reagents	500
An initial supply of glassware	500
A calculator for figuring results	350

Maintenance, adjustment, and operation of equipment is an important part of the training of technicians. For this purpose, it is suggested that the feed laboratory be used as the basic laboratory for the course *Physical Facilities and Care of Equipment*. This will give students an opportunity to practice and study the maintenance, adjustment, operation, and safety practices to be followed when using laboratory equipment.

The final choice of equipment should be decided by the appropriate instructors who are familiar with equipment and the needs of the industry. They may be assisted by an advisory committee of industry representatives. The needs of the industry will vary in different geographic areas of the country, and these variations should be reflected in the choice of equipment.

Suggested Laboratory Equipment

Following is a suggested list of equipment necessary for the grain, feed, seed, and farm supply program for a class of 16 students. With very few exceptions, this equipment represents a minimum for the technical curriculum outlined in this guide. If an adequate occupational experience program can be assured for every student, it might be possible to omit some items. However, the soil testing equipment and the seed and grain cleaning, grading, and testing equipment should always be provided to assure students adequate experience in these phases of their work as employees.

Agronomy Laboratory Equipment

Item	*Quantity*
Atomic absorption spectrophotometer	1
Balance, torsion	1
Balance, trip	4
Beaker, 100 ml. capacity	50
Beaker tong	10
Bench, growing, 2′ x 4′, five shelves	4
Brush, counter	8
Brush, floor, 14″	2
Bulletin board	2
Flame photometer	2
Funnel, 50 mm. dia.	10
Funnel, 8″ dia.	6
Graduate, 100 ml.	10
Graduate, 500 ml.	6
Moisture meter, Bouyoucos	1
Oven, laboratory	1
pH meter	4
Shovel, round point	4
Soil auger, 40″	4
Soil auger, extension 36″	1
Soil sample shaker	1
Soil sieve, set	1
Soil thermometer	4
Spectrophotometer or colorimeter	1
Test tube brush	10

Test tube clamp	20
Test tube	200

Feed Laboratory Equipment

Item	*Quantity*
Animal cage	24
Balance, analytical	1
Balance, single beam trip	2
Balance, torsion	1
Cleaner, control feed hopper and motor	1
Grain triers	1 each
40″ trier with partitions	
63″ trier, government special, double partitions	
6″ bag trier	
9″ bag trier	
12″ bag trier	
Lamp guard, vapor-proof, portable with 25′ cord	1
Scale, platform	1

Grain and Seed Laboratory Equipment

Item	*Quantity*
Analyzer, Udy protein	1
Balance, analytical, torsion, or equivalent	1
Balance, torsion	1
Balance, torsion, with brass scoop with 700-gram weight or equivalent	2
Barley pearler	1
Brush, counter, 8″	8
Brush, floor, 14″	2
Carter dockage tester with full complement of grain sieves and riddles (source—Simon-Carter Company, Minneapolis, Minn.)	1
Cart, laboratory, shelf size 36″ x 24″	2
Cleaner, seed, office size	1
Combination grain viewer and black light	2
Disc cylinder separator	1
Fire extinguisher	4
Forceps, grain	16
Germinator, seed	1
Grain sample bag	100
Grain sample bottle, government standard	100
Grain sample canvas	1
Light, simulation of North sky daylight at 7,400° K.	4
Magnifier, desk size, tripod	8
Oil and fat tester, Steinlite, LOS-300	1
Plastic bottle, pint size	24
Sample pan	50
Scales, gram, triple beam	7
Scoop, grain	6
Screen rack for 12 x 12 grain grading screens	1
Screens, set, grain grading, 12 x 12	4
Seed sampler, Boerner	2
Sieves:	
Set, four sieves, wheat, corn, rye, oats, and bottom	1
Set, three sieves and bottom pan, flaxseed, No. 13, precision	1
Set, three sieves and bottom pan, rice, No. 8	1
Set, two sieves and bottom pan, grain sorghum, No. 9, precision	1
Set, sizing, barley, Eastern 5/64″ x 3/64″; Western, 5-1/2/64 x ¾″; and bottom pan	1
Set, barley, special sizing sieves (5-1/2, 6/64, and 6-1/4), used by the trade to determine degree of plumpness	1
Set, two sieves and bottom, soybeans, No. 17	1
Buckwheat sieve, large	1
Lima bean sieves:	
24/64″ round hole	1
28/64″ round hole	1
30/64″ round hole	1
Pea sieves, hand:	
10/64 x ¾″ slot	1
11/64 x ¾″ slot	1
12/64 x ¾″ slot	1
13/64 x ¾″ slot	1
14/64 x ¾″ slot	1
2-1/2/64″ round hole	1
6/64″ round hole	1
8/64″ round hole	1
9/64″ round hole	1
10/64″ round hole	1
12/64″ round hole	1
15/64″ round hole	1
16/64″ round hole	1
Weevil sieve	1
Strand sizer shaker or equivalent	1
Tester, moisture, Motomco	2

Tester, Steinlite, moisture	1
Tester, wt./bu. apparatus	1
Tester, wt./bu. hand testers	5
Thermometer, storage and dryer, 6-foot capillary	1
Thermometer, 0 to 120 degrees	6

TOOLS

Item	*Quantity*
Allen wrench sets, 5/32, 3/16, 7/32, 1/4, 5/16	5
Electrician's pliers	8
Fuse puller	4
Hydraulic jack, 5-ton capacity	2
Level, 24″	2
Oil can, 1-pint capacity	5
Screw drivers:	
3″ blade	10
4″ blade	10
8″ blade	10
10″ blade	10
Socket wrench sets, ¾″ drive; 1-1/16, 1-1/8, 1-1/4, 1-5/16, 1-7/16, 1-1/2, 1-3/8, 1-11/16, 1-13/16, 1-7/8, 2″	5
Steel square	2
Tape, 12′	8
Wrenches:	
Adjustable, 6″	10
Adjustable, 8″	10
Pipe, 8″	2
Pipe, 14″	2

Summary of Laboratory and Equipment Costs

The listed equipment is basic and does not include items for highly specialized programs in such areas as fertilizer manufacturing technology. In addition to funds for the basic equipment, a sum of $5,000 to $8,000 should be earmarked for special equipment to meet local needs for program specialities. Purchase cost of expendable materials and supplies is estimated at an additional $500 to $600.

These estimates do not provide for the cost of the building, which, if constructed for the program, may be calculated at $16 to $20 per square foot of unfinished laboratory space. The space with built-in furnishings, without portable equipment, may be estimated at $20 to $30 per square foot.

Therefore, the total initial cost for a program for the grain, feed, seed, and farm supply industry, based on 1966 prices, may be estimated as follows.

Summary of Estimated Costs

	Range of cost	
Basic Equipment:		
Agronomy Laboratory	$ 8,500	$ 9,500
Feed Laboratory	1,700	2,200
Grain and Seed Laboratory	8,800	9,600
Total	19,000	21,300
Specialized Equipment:		
Agronomy Laboratory	2,000	3,000
Feed Laboratory	2,000	3,000
Grain and Seed Laboratory	1,000	2,000
Total	5,000	8,000
Tables, Demonstration Tables, Storage Cabinets:		
Agronomy Laboratory	2,500	2,800
Feed Laboratory	2,000	2,400
Grain and Seed Laboratory	2,500	2,800
Total	7,000	8,000
Tools	500	800
Supplies	500	600
Expendable Materials, Chemicals, Antibiotics, Feed Additives, etc.	500	600
Grand Total	32,500	39,300

SELECTING LIBRARY MATERIALS

The value of the library to the preparation of technicians has been emphasized earlier in this guide. It is essential that students learn not only how to use the library but also that they learn the importance of utilizing the library resources for broadening their knowledge and understanding and for keeping abreast of the technology. To develop these concepts, it is important that the school provide the best possible facilities.

The first section of the Bibliography may be used as a first step in selecting suitable references for the technology. These may later be supplemented, with materials that provide new and more nearly up-to-date information. For various geographic areas of the United States, it will be desirable for instructors to accumulate reference materials particularly adapted to the area; for example, references particularly concerned with the irrigated sections of the country and those suitable for the Southern States should be incorporated in libraries located in these areas.

It is important for individuals working at the technological or managerial level in industry to keep themselves up-to-date on the latest discoveries, applications, and research in their fields. For this purpose, it is highly desirable that students become well acquainted with trade magazines and other periodicals related to their specific fields. The bibliography includes a list of trade magazines which might be made available in libraries where training is provided for the grain, feed, seed, and farm supply industry.

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The Feed Bag. Editorial Service Company, 1712 West St. Paul Avenue, Milwaukee, Wisc. 53233.

The Feed Bag Red Book. Editorial Service Company, 1712 West St. Paul Avenue, Milwaukee, Wisc. 53233.

Feed and Farm Supplier. Watt Publishing Company, Sandstone Building, Mt. Morris, Ill. 61054.

Feed/Grain Equipment Times. Select Publications, Inc., 900 Northstar Center, Minneapolis, Minn. 55402.

Feed Management. Garden State Publishing Company, Garden State Building, Sea Isle City, N.J. 08243.

Feed Market News. U.S. Department of Agriculture, Consumer and Marketing Service, Washington, D.C. 20250.

Feed Situation. U.S. Department of Agriculture, Economic Research Service, Washington, D.C. 20250.

Feedlot. Miller Publishing Company, 2501 Wayzata Boulevard, Minneapolis, Minn. 55405.

Feeds Illustrated. National Provisioner, 15 West Huron Street, Chicago, Ill. 60610.

Feedstuffs. Miller Publishing Company, 2501 Wayzata Boulevard, Minneapolis, Minn. 55405.

Feedstuffs Feed Additive Compendium. Miller Publishing Company, 2501 Wayzata Boulevard, Minneapolis, Minn. 55405.

Foreign Agriculture. U.S. Department of Agriculture, Economic Research Service, Washington, D.C. 20250.

Grain Age. Editorial Service Company, Inc., 152 West Wisconsin Avenue, Milwaukee, Wisc. 53203.

Grain and Feed Journals. Grain and Feed Journals Consolidated, 1115 Board of Trade Building, Chicago, Ill. 60604.

Grain Market News. U.S. Department of Agriculture, Consumer and Marketing Service, Washington, D.C. 20250.

Grain Terminals and Processing Plants. Grain Elevator and Processing Superintendents Society, Board of Trade Building, Chicago, Ill. 60604.

Hog Farm Management. Miller Publishing Company, 2501 Wayzata Boulevard, Minneapolis, Minn. 55405.

Home and Garden Supply. Miller Publishing Company, 2501 Wayzata Boulevard, Minneapolis, Minn. 55405.

Journal of Animal Science. American Society of Animal Science. 39 Sheridan Avenue, Albany, N.Y. 12210.

Journal of the Association of Official Analytical Chemists. The Association of Official Analytical Chemists, 414 Water Street, Baltimore, Md. 21202.

Journal of Farm Economics. American Farm Economics Association, Menasha, Wisc. 54952.

Livestock and Meat Situation. U.S. Department of Agriculture, Economic Research Service, Washington, D.C. 20250.

Marketing and Transportation Situation. U.S. Department of Agriculture, Economic Research Service, Washington, D.C. 20250.

Modern Miller and Baker News. Modern Miller Company, 100 South Parkway, Prospect Heights, Ill. 60070.

Northwestern Miller. Miller Publishing Company, 2501 Wayzata Boulevard, Minneapolis, Minn. 55405.

Plant Food Review. National Plant Food Institute, 1700 K Street, N.W., Washington, D.C. 20006.

Poultry and Egg Situation. U.S. Department of Agriculture, Economic Research Service, Washington, D.C. 20250.

Poultry and Livestock Comment. E. I. Dupont de Nemours and Company, Inc., Industrial and Chemical Department, Wilmington, Del. 19801.

Poultry and Livestock Mixed Feeds. U.S. Department of Commerce, Bureau of the Census, Washington, D.C. 20203.

Rice Situation. U.S. Department of Agriculture, Economic Research Service, Washington, D.C. 20250.

Seed Trade News. Seed Trade News, Inc., 222 West Adams Street, Chicago, Ill. 60606.

Seed World. Seed World Publications, 327 South LaSalle Street, Chicago, Ill. 60604.

Soil Science. Soil Science Society of America, 677 South Segoe Road, Madison, Wisc. 53711.

Southwestern Miller. Sosland Publishing Company, 860 Board of Trade Building, 1005 Wyandotte Street, Kansas City, Mo. 64105.

Turkey Producer. Jack Long, Editor, 180 North Wabash Avenue, Chicago, Ill. 60601.

Wheat Situation. U.S. Department of Agriculture, Economic Research Service, Washington, D.C. 20250.

Wool Situation. U.S. Department of Agriculture, Economic Research Service, Washington, D.C. 20250.

APPENDIX I

A SELECTED LIST OF SCIENTIFIC AND TECHNICAL SOCIETIES, TRADE ASSOCIATIONS, AND GRAIN EXCHANGES

Scientific and technical societies, trade associations, and grain exchanges provide a unique service for instructors and students engaged in technical education programs. Publications of these organizations provide much up-to-date material regarding the industry. Sometimes these appear as charts, sets of graphs, or overhead transparencies. Many associations produce motion pictures, sets of slides, and filmstrips which are used extensively by schools. Some associations publish one or more periodicals to which schools may subscribe. These serve to provide up-to-date information concerning the aspects of the industry served by the association.

Associations and societies may also furnish resource persons to speak to classes or to serve as hosts to groups of students on field trips.

Less conspicuous but nonetheless important help of associations in the educational program is the support which the associations may give (1) in showing evidence of need for a training program, (2) in helping to promote the program in appropriate areas, (3) in enlisting the support of member firms for the program, (4) in providing stations for occupational experience of students, and (5) in helping with the placement of graduates.

Instructors and others desiring information from the following organizations may address inquiries to the executive secretary of the organization.

AGRICULTURAL AMMONIA INSTITUTE, 703 Dupont Building, Memphis, Tenn. 38103.

Founded in 1951 for producers and distributors of anhydrous ammonia and for equipment manufacturers.

Publication: *Agricultural Ammonia News*, bimonthly.

AMERICAN ASSOCIATION OF CEREAL CHEMISTS, 1955 University Avenue, St. Paul, Minn. 55104.

A professional society founded in 1915 for chemists and milling, baking, feed, and allied industries. The purpose is to encourage research and to develop and standardize analytical methods in the cereal industry.

Publications: *Cereal Chemistry*, bimonthly; *Cereal Science Today*, ten issues a year.

AMERICAN CHEMICAL SOCIETY, 1155–16th Street, N.W., Washington, D.C. 20036.

A scientific, educational, and professional society of chemists and chemical engineers, founded in 1876. Has many divisions, such as: agriculture and food, analytical, biological, carbohydrate, fertilizer, and soil.

Publications: *Journal of Agriculture and Food Chemistry; Chemical and Engineering News.*

AMERICAN CORN MILLERS FEDERATION, 1000 Connecticut Avenue, N.W., Suite 608, Washington, D.C. 20036.

An organization of manufacturers of dry corn meal founded in 1918. Conducts educational programs in production, sanitation, and marketing.

Publications: *Corn Talks* and *Corn Meal News.*

AMERICAN DEHYDRATORS ASSOCIATION, 800 West 47th Street, Room 512, Kansas City, Mo. 64112.

An association of alfalfa dehydrator firms and suppliers founded in 1941.

Publications: *ADA Newsletter*, periodic bulletins.

AMERICAN FEED MANUFACTURERS ASSOCIATION, 53 West Jackson Boulevard, Chicago, Ill. 60604.

An association of feed manufacturers founded in 1909. Has committees on traffic, feed control relations, market research, and nutrition.

Publications: *AFMA Newsletter; Management Guide, Livestock, Dairy, Poultry; Feed Production Handbook; Short Course for Local Feed Mills, 1962; Small Mill Short Course, 1959;* miscellaneous other publications.

AMERICAN MANAGEMENT ASSOCIATION, 1515 Broadway, New York, N.Y. 10036.

Founded in 1923, "to provide the training, research, publications, and information services required by managers to do a better job. To organize and encourage exchange of management thinking and experience within the profession."

Publications: *Managers' Letter,* monthly; *Management News,* monthly; *Management Review,* monthly; *Supervisory Management,* monthly; *Personnel,* bimonthly.

AMERICAN POTASH INSTITUTE, 1102–16th Street, N.W, Washington, D.C. 20036.

Founded in 1935 for producers of potash salts used in manufacturing fertilizer. Conducts research program in agricultural use of potash.

Publications: *Better Crops with Plant Food,* bimonthly; *Soil Fertilizer and Soybeans.* Also slides: *Safe and Effective Fertilizer Placement.*

AMERICAN SEED TRADE ASSOCIATION, Executive Building, Suite 964, Washington, D.C. 20005.

Founded in 1883 to promote better seeds. An association of breeders, growers, and assemblymen.

Publications: *Hybrid Corn* and *Farm Seed Conference Proceedings.*

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS, 420 Main Street, St. Joseph, Mich. 49085.

Founded in 1907 as a professional society of agricultural engineers employed in industries serving agriculture and in public service. Committees deal with equipment, safety, soils, application of fertilizers and chemicals, uses of electricity, and many other aspects.

Publications: *Agricultural Engineering,* monthly; *Transactions,* quarterly; *Agricultural Engineers' Yearbook.*

AMERICAN SOCIETY OF AGRONOMY, 677 South Segoe Road, Madison, Wis. 53711.

A professional society of agronomists, plant breeders, soil scientists, chemists, technicians, and others concerned with farm crops and soils and conditions affecting them; founded in 1907.

Publications: *Agronomy Journal,* bimonthly; *Crops and Soils,* 9 issues a year.

AMERICAN SOCIETY OF ANIMAL SCIENCE, 39 Sheridan Avenue, Albany, N.Y. 12210.

Founded in 1908 as a professional society of persons engaged in investigation, instruction, or extension in animal science or production of livestock products.

Publications: *Journal of Animal Science.*

ANIMAL HEALTH INSTITUTE, 1030–15th Street, N.W., Washington, D.C. 20005.

Founded in 1940 as an organization of manufacturers of antibiotics, drugs, and chemicals used for animal health and nutrition.

Publications: *AHI Reporter,* monthly.

ANIMAL NUTRITION RESEARCH COUNCIL, Monsanto Chemical Company, 800 North Lindberg Street, St. Louis, Mo. 63141.

Founded in 1939. Conducts research on animal feeds. Stimulates research on animal feeds and collaborative studies of assay methods for nutritional factors.

Publications: *ANRC Newsletter,* semi-annual.

ASSOCIATION OF MILL AND ELEVATOR MUTUAL INSURANCE COMPANIES, 2 North Riverside Plaza, Chicago, Ill. 60606.

An association of companies that insure elevators and grain and feed mills. Founded in 1908.

Publications: *Spontaneous Heating in Feeds, Grains and Hay;* miscellaneous other publications.

BARLEY AND MALT INSTITUTE, 200 Temple Building, 620 Lee Street, Des Plaines, Ill. 60016.

Founded in 1946 as an association of manufacturers of dry malt.

Publications: *Malt Newsletter,* weekly.

CHICAGO BOARD OF TRADE, 141 West Jackson Boulevard, Chicago, Ill. 60604.

A commodity exchange for grain and other agricultural products founded in 1848.

Publications: Futures reports on such commodities as oats, soybeans, and soybean oils.

CORN INDUSTRIES RESEARCH FOUNDATION, 1001 Connecticut Avenue, N.W., Washington, D.C. 20036.

A foundation of corn refining firms which manufacture corn starches, sugars, and syrups by wet process. Founded in 1912.

Publications: *Corn,* quarterly; also pamphlets on corn refining and corn products.

COUNCIL FOR AGRICULTURAL AND CHEMURGIC RESEARCH, 350 Fifth Avenue, New York, N.Y. 10001.

An association of farmers, scientists, and industrialists seeking discovery of new, non-farm uses of farm crops through chemurgic upgrading. Founded in 1925.

Publications: *Chemurgic Digest,* 8 issues a year.

DISTILLERS FEED RESEARCH COUNCIL, 1232 Enquirer Building, Cincinnati, Ohio 45202.

A council of beverage distillers who process grain and recover animal feed and other products as by-products. Founded in 1947.

Publications: *Annual Proceedings.*

GRAIN AND FEED DEALERS NATIONAL ASSOCIATION, 725–15th Street, N.W., Washington, D.C. 20005.

An association of wholesalers and retailers of grain and feed for livestock and associated businesses. Founded in 1896.

Publications: *Newsletter,* weekly; *Feed and Feeding Digest,* semi-monthly.

KANSAS CITY BOARD OF TRADE, Board of Trade Building, Kansas City, Mo. 64105.

A grain commodity exchange founded in 1871.

MALTING BARLEY IMPROVEMENT ASSOCIATION, 828 North Broadway, Milwaukee, Wisc. 53202.

Founded in 1945. Conducts research program.

MIDWEST FEED MANUFACTURERS ASSOCIATION, 934 Wyandotte Street, Kansas City, Mo. 64105.

An organization of feed manufacturers and associates, such as equipment manufacturers, chemical producers, and bag manufacturers; sponsors feed production school and a nutrition clinic; founded in 1944.

Publications: Proceedings of the feed production school and the nutrition clinic.

MINNEAPOLIS GRAIN EXCHANGE, 150 Grain Exchange Building, Minneapolis, Minn. 55415.

An association of individuals engaged in trading on the Minneapolis Grain Exchange. Founded in 1881.

Publications: *Grain Exchange News,* monthly; movies.

NATIONAL ACADEMY OF SCIENCES, NATIONAL RESEARCH COUNCIL, 2101 Constitution Avenue, N.W., Washington, D.C. 20037.

Founded in 1951, the Agricultural Research Institute of the National Academy of Sciences has many committees dealing with different agricultural problems such as nutrition, crop varieties, and health. It was organized to stimulate the kind of research and policies needed to insure best utilization of agricultural resources in the national economy.

Publications: Miscellaneous publications include quarterlies on laboratory animals and nutrient requirements of animals for research.

NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION, 1145–19th Street, N.W., Washington, D.C. 20036.

Firms engaged in producing agricultural chemicals or ingredients for them, such as sprays, herbicides, and insecticides; conducts research, promotes safety; founded in 1934.

Publications: *N. A. C. News,* pamphlets, manuals.

NATIONAL FEDERATION OF GRAIN COOPERATIVES, 711–14th Street, N.W., Washington, D.C. 20005.

Membership includes several large grain cooperatives.

Publications: *Grain Quarterly.*

NATIONAL FERTILIZER SOLUTIONS ASSOCIATION, 1146 Jefferson Building, Peoria, Ill. 61602.

Founded in 1957 for manufacturers, wholesalers, and dealers of nitrogen solutions and mixed liquid fertilizers, equipment manufacturers, and chemical producers.

Publications: *Solutions,* bimonthly; filmstrips.

NATIONAL GRAIN TRADE COUNCIL, 604 Folger Building, 725–15th Street, N.W., Washington, D.C. 20005.

Membership consists of several grain exchanges and grain trade associations.

Publications: *Newsletter,* weekly.

NATIONAL PLANT FOOD INSTITUTE, 1700 K Street, N.W., Washington, D.C. 20006.

Founded in 1876; members are manufacturers, importers, and brokers of fertilizer and fertilizer materials; conducts programs for better acceptance of fertilizer and support of research and dissemination of research findings.

Publications: *Plant Food Review,* quarterly; regional plant food bulletins; leaflets and booklets on fertilizer and land management.

NATIONAL SAFETY COUNCIL, 425 North Michigan Avenue, Chicago, Ill. 60603.

Founded in 1913, its purpose is to reduce the number and severity of all kinds of accidents.

Publications: *Catalog of Publications, Farm Safety Review.*

NATIONAL SOYBEAN PROCESSORS ASSOCIATION, 211 South Race Street, Urbana, Ill. 61801.

Founded in 1930 to improve the production and lower the costs of soybeans. Cooperates with colleges, USDA, and others on research.

Publications: *Soybean News, Soybean Farming.*

SOYBEAN COUNCIL OF AMERICA, 408 Marsh Building, Waterloo, Iowa 50703.

Founded in 1956, a council of soybean processors and grain handlers; promotes use of American soybeans and soybean products throughout the world; maintains offices in Europe, South America, and Asia.

Publications: *International News,* monthly; *Oil and Protein Around the World,* monthly.

UNITED STATES FEED GRAINS COUNCIL, 1616 H Street, N.W., Washington, D.C. 20006.

Members are grain processors, grain producers, seed traders, exporters, grain dealers, and feed and feed supplement manufacturers; maintains overseas offices for development of markets for corn, grain sorghum, oats, barley, alfalfa, feed additives, and other feedstuffs.

Publications: *Information Bulletin,* monthly.

The following State or regional associations may be contacted by instructors and school administrators for assistance in developing training programs, furnishing resource persons, and providing instructional materials within the service area of the associations:

ARIZONA GRAIN AND SEED ASSOCIATION, Box 1426, Mesa, Ariz. 85201.

ARKANSAS DRIER AND WAREHOUSEMAN'S ASSOCIATION, Box 710, Helena, Ark. 72342.

CALIFORNIA GRAIN AND FEED ASSOCIATION, 1400 Tenth Street, Sacramento, Calif. 95814.

CALIFORNIA WAREHOUSEMEN'S ASSOCIATION, 9 First Street, San Francisco, Calif. 94105.

CAROLINAS-VIRGINIA GRAIN AND FEED DEALERS ASSOCIATION, Box 927, Rocky Mount, N.C. 27801.

COLORADO GRAIN AND FEED DEALERS ASSOCIATION, 519 Boston Building, Denver, Colo. 80202.

EASTERN FEDERATION OF FEED MERCHANTS, Sherburne, N.Y. 13460.

EASTERN SHORE GRAIN AND FEED DEALERS ASSOCIATION, Box 4, Williamsburg, Md. 21674.

FARMERS ELEVATOR ASSOCIATION OF MINNESOTA, 512 Grain Exchange, Minneapolis, Minn. 55415.

FARMERS ELEVATOR ASSOCIATION OF SOUTH DAKOTA, 423 Citizens Building, Aberdeen, S.D. 57401.

FARMERS GRAIN DEALERS ASSOCIATION OF ILLINOIS, 1236 East Empire Street, Bloomington, Ill. 61701.

FARMERS GRAIN DEALERS ASSOCIATION OF NORTH DAKOTA, 513 Black Building, Fargo, N.D. 58102.

FEDERATION OF CASH GRAIN COMMISSION MERCHANTS ASSOCIATION, Suite A, Grain Exchange Building, Omaha, Nebr. 68102.

FLORIDA FEED ASSOCIATION, INC., c/o Florida Feed Mills, Warren Goodwin, Secretary, Box 2331, Jacksonville, Fla. 32203.

GEORGIA FEED ASSOCIATION, INC., Room 227, 3166 Maple Drive, N.W., Atlanta, Ga. 30305.

IDAHO FEED AND GRAIN ASSOCIATION, Box 60, Burley, Idaho 83318.

ILLINOIS GRAIN AND FEED ASSOCIATION, INC., 410 Central Bank Building, Peoria, Ill. 61602.

INDIANA GRAIN AND FEED DEALERS ASSOCIATION, INC., 502 Board of Trade Building, Indianapolis, Ind. 46204.

IOWA GRAIN AND FEED ASSOCATION, 201 Shops Building, Des Moines, Iowa 50309.

KANSAS GRAIN AND FEED DEALERS ASSOCIATION, 609 Wiley Building, Hutchinson, Kans. 67501.

KENTUCKY FEED AND GRAIN ASSOCIATION, Box 425, Lexington, Ky. 40501.

LOUISIANA GRAIN AND FEED DEALERS ASSOCIATION, INC., c/o Dr. C. W. Pope, Secretary-Treasurer, Knapp Hall, Louisiana State University, Baton Rouge, La. 70803.

MICHIGAN BEAN SHIPPERS ASSOCIATION, 500 Eddy Building, Saginaw, Mich. 48604.

MICHIGAN FEED AND GRAIN DEALERS ASSOCIATION, Box 472, East Lansing, Mich. 48823.

MIDSOUTH SOYBEAN AND GRAIN SHIPPERS ASSOCIATION, Box 687, Blytheville, Ark. 72315.

MISSISSIPPI FEED AND GRAIN ASSOCIATION, Box 4357, Jackson, Miss. 39216.

MISSOURI GRAIN AND FEED ASSOCIATION, Higginsville, Mo. 64037.

NEBRASKA GRAIN AND FEED DEALERS ASSOCIATION, 818 Terminal Building, Lincoln, Nebr. 65808.

NEW MEXICO GRAIN AND FEED DEALERS ASSOCIATION, 2640 El Paseo Road, Las Cruces, N.M. 88001.

NORTHWEST COUNTRY ELEVATOR ASSOCIATION, 920 Grain Exchange Building, Minneapolis, Minn. 55415.

NORTHWEST RETAIL FEED ASSOCIATION, INC., Box 854, Mankato, Minn. 56001.

N. W. FEED MANUFACTURERS ASSOCIATION, 2501 Wayzata Boulevard, Minneapolis, Minn. 55405.

OHIO GRAIN AND FEED DEALERS ASSOCIATION, INC., 5625 North High Street, Box 151, Worthington, Ohio 43085.

OKLAHOMA GRAIN AND FEED DEALERS ASSOCIATION, Box 38, Union City, Okla. 73090.

OREGON FEED, SEED, AND SUPPLIERS ASSOCIATION, 316 Henry Building, Portland, Oreg. 97204.

PACIFIC NORTHWEST GRAIN DEALERS ASSOCIATION, INC., 514 Peyton Building, Spokane, Wash. 99201.

PENNSYLVANIA MILLERS AND FEED DEALERS ASSOCIATION, Box 329, 119 East Main Street, Ephrata, Pa. 17522.

TEXAS GRAIN AND FEED ASSOCIATION, 504 Fort Worth Club Building, Fort Worth, Tex. 76102.

UTAH FEED MANUFACTURERS AND DEALERS ASSOCIATION, c/o Dr. Jay O. Anderson, Secretary, Animal Science Department, Utah State University, Logan, Utah 84321.

WEST VIRGINIA FEED DEALERS ASSOCIATION, 709 Barbara Street, Barboursville, W.Va. 25504.

WISCONSIN FEED, SEED, AND FARM SUPPLY ASSOCIATION, INC., 152 West Wisconsin Avenue, Milwaukee, Wisc. 53203.

WYOMING GRAIN, FEED AND SEED DEALERS ASSOCIATION, 515 North Broadway, Riverton, Wyo. 82501.

APPENDIX II

SAMPLE INSTRUCTIONAL MATERIALS

Instructors for the grain, feed, seed, and farm supply technology should make the best possible use of all available instructional facilities including laboratories, library, classrooms, and community resources which are available. In many instances, textbooks are inadequate to provide the subject matter materials needed for the grain, feed, seed, and farm supply industry. It is therefore necessary for instructors to develop laboratory projects and demonstrations which will provide a sound basis for an understanding of the technical aspects of the industry and which will supplement the occupational experience parts of the training program.

Typical Material for a Unit of Instruction

A full-time technical instructional program gains great strength from coordinated learning activities. Such activities include classroom instruction, directed study, demonstrations, examinations, problems, laboratory experiences, and reports. The multiple-approach method of learning includes classroom lecture outline, reading references, problem assignment, laboratory projects, and examination.

Sample Laboratory Report

The preparation of appropriate laboratory reports is an effective part of the teaching and learning process. It is a form of instruction that requires an organized, systematic approach and leads to a logical conclusion. Properly used, it can promote clear thought, strengthen skills of communication, and develop personal pride and motivation among students.

The nature of laboratory reporting will vary, depending on the time available, the nature of the material to be reported, and the purposes of the various projects. The course outlines in which laboratory projects are listed suggest the types of reports which may be prepared. In some cases, these will be formal research reports, including (1) a statement of the problem, (2) a review of related literature, (3) the plan of the project, (4) results, and (5) summary and conclusions together with a complete bibliography. In other cases, the report may be in the form of a letter, a radio or TV script, a report of an interview, or a copy of a talk to be given orally.

Text and Reference Materials

Text and reference materials should be carefully selected by the instructors of the respective courses. The outlines in the guide suggest text and reference materials for the subject matter covered by the outline. In many cases, instructors will need to select several sources to secure references covering the material for the grain, feed, seed, and farm supply industry. While there is much text material available, it will be found in many scattered bulletins and pamphlets rather than compiled in the more familiar textbooks.

Teaching Guide

Following are examples of a plan for two classes and two laboratory projects for the *Retail Farm Supply Merchandising* course. These may be used as a suggested pattern for an instructional plan to be followed by the instructor.

Course: *Retail Farm Supply Merchandising* (Third Semester)
  Division I. Make a Market Survey
    Section A. Define the Trade Area
    Class 1. Present and Potential Boundaries of the Trade Area
    Class 2. The Characteristics of the Trade Area
    Class Time: Two 50-minute periods

Class Outlines
  Class 1. Present and Potential Boundaries of the Trade Area

References:

Clark, Eugene, Rayburn D. Tousley, and Fred E. Clark, *Principles of Marketing*. New York, N.Y. 10011: The Macmillan Company, 1962.

Kirkpatrick, C .A., *Salesmanship*. Cincinnati, Ohio 45227: South Western Publishing Company, 1966.

Phillips, Charles F., and Delbert Duncan, *Retailing Principles and Methods*. Homewood, Ill. 60430: R. D. Irwin Company, Inc., 1964.

Wingate, John W., and Elmer O. Schaller, *Techniques of Retail Merchandising*. Englewood Cliffs, N.J. 07632: Prentice-Hall, Inc., 1964.

I. Trade Areas Defined
  A. Boundaries
  B. History

II. Factors Affecting Size of the Trade Area
  A. Transportation—roads, equipment
  B. Communications—telephone, radio, TV
  C. Location of competing firms
  D. Services provided

Class 2. The Characteristics of the Trade Area

References:

Clark, Eugene, Rayburn D. Tousley, and Fred E. Clark, *Principles of Marketing*. New York, N.Y. 10011: The Macmillan Company, 1962.

Kirkpatrick, C. A., *Salesmanship*. Cincinnati, Ohio 45227: South Western Publishing Company, 1966.

Phillips, Charles F., and Delbert Duncan, *Retailing Principles and Methods*. Homewood, Ill. 60430: R. D. Irwin Company, Inc., 1964.

Wingate, John W., and Elmer O. Schaller, *Techniques of Retail Merchandising*. Englewood Cliffs, N.J. 07632: Prentice-Hall, Inc., 1964.

I. Characteristics of the Agriculture of the Area
  A. Livestock
  B. Crops
  C. Size of operations

II. Degree of Specialization in the Area
  A. Recreation areas
  B. Special crops
  C. Urbanization

III. Characteristics of the People
  A. Nationality
  B. Financial capacity

IV. Trends in the Area
  A. Agricultural
  B. Industrial
  C. Recreational

V. Use of United States Census of Agriculture to Define the Trade Area

Laboratory Procedures:

Laboratory 1. Define the Trade Area

Purpose: To develop the ability to accurately define the trade area of the local grain, feed, seed, and farm supply center.

Discussion: The trade area may be defined in terms of the geographic area it encompasses; however, an accurate definition of the area requires analysis of the characteristics of the territory in addition to identification of its boundaries. A territory located in a cut-over forest area on unproductive agricultural soil might be very extensive in geographic area yet very limited in terms of potential sales of feeds, seeds, or fertilizer. On the other hand, a relatively small territory with a very heavy concentration of feedlot operators would have a strong potential for feed sales. Other factors such as roads and telephone communication are important in determining sales potential for a local business.

Equipment and Materials Needed:

1. Maps of the county or counties served by the farm service center, with each farm and business place located on the map.
2. U.S. census data for the counties.
3. Cross-section paper, ¼-inch.
4. Lettering set, LeRoy, Wrico, or equivalent, or lettering pencils and pens.
5. List of customers of local farm supply center or a hypothetical list of customers.

Procedure:

1. Mark the location of the customers on the map.
2. Enclose the geographic area by connecting the points at the extreme edge of the territory.
3. Mark the location of competitors either inside the territory or in nearby areas outside the territory.

Laboratory 2. Present and Potential Boundaries of the Trade Area Procedure:

1. Use the census data for the counties involved, and compile for three or four 5-year

census periods the number and kinds of livestock and poultry and the acreage and yield of each kind of crop. If only parts of counties are served, pro-rate the poultry, livestock, and crops in proportion to the area of the counties included in the territory.

2. Prepare bar graphs for each kind of livestock and poultry, showing changes in numbers of livestock and poultry in the territory.
3. Prepare bar graphs for each kind of livestock and poultry, showing changes in production for the territory.
4. Prepare bar graphs to show changes in acreage and production of each kind of crop over the past 15 to 20 years.
5. Locate on the map the areas of specialization that can be identified as:
    a. recreation areas, such as ski resorts, camping, fishing, and hunting areas
    b. specialized crop areas, such as for vegetables, cranberries, apples.
    c. hilly, non-tillable grazing land
    d. suburban residential areas
6. Secure data on average feed intake of each kind of livestock and poultry to estimate the potential feed consumption of livestock in the territory.
7. Select a sample of livestock producers in the territory, and determine by interview the proportion of feed which is purchased, the proportion (either farm-grown or purchased) which is processed or ground, and the proportion which is purchased at the mill.
8. Using the data obtained in No. 7, prepare a graph showing the feed purchased and the feed processed in the territory.
9. Repeat the above procedure for crops to determine seeds purchased, seeds cleaned and treated, and fertilizers and agricultural chemicals such as herbicides, fungicides, and insecticides used in the territory.
10. Compare your findings with the county reports from the Bureau of the Census which show production of crops and livestock and purchases of feed, fertilizer, seed, and other supplies by farmers.

APPENDIX III

OCCUPATIONAL EXPERIENCE FORMS

Plan of Occupational Experience Program

Name____
(Last) (First) (Middle)

Home Address____
(Number and Street) (City) (State)

Course____

Name of Employer______________________________________

Address of Employer____________________________________

Dates of Employment: Beginning________________ Closing________________

Job Processes in which student will receive instruction and remuneration:

Job	*Approximate Time on Each Job*
Grain Receiving	________________
Feed Room	________________
Trucking (Pick-up and Delivery)	________________
Counter Sales	________________
Housecleaning	________________
Fertilizer	________________
Seed Cleaning and Treating	________________
Safety Checks	________________
Others:________________	________________
________________	________________

Daily Hours of Work:________________a.m. to________________p.m.

Days per Week:________________

Remuneration—Employer is to pay this student per hour: ________________

or per week: ________________

or per month:________________

Signed: Approved by Employer________________________________

Approved by Employee________________________________

Approved by Coordinator________________________________

Monthly Report of Occupational Experience

Report of ______________________ for month of ______________________, 19____

Name and Address of Employer____

Work Experience

Breakdown of Jobs Performed (Delivery, Grain Receiving, Feed Mill, Counter Sales, etc.)	Approximate No. of Hours on Each Job Per Month

Total number of hours worked:____

New Experiences This Month:

____

____

____

____

Experiences or Skills I Would Like to Gain:

____

____

____

Time Absent From Duty: Days______________

Hours______________

Reason for Absence______________

Number of Personal Conferences—
Manager and Trainee______________

____

Submitted by:______________
(Trainee)

Verified by:______________
(Employer)

____
(Coordinator)

Summary Report of Occupational Experience

To the Student:

General Instructions: You are required to submit a comprehensive term paper on your occupational experience. The report will be graded for completeness, accuracy, and neatness and become a part of your record.

You are expected to submit the report in a standard report cover (8½ x 11), complete with title page and table of contents. The report must be typed or in ink on plain white (8½ x 11) paper. Graph paper may be used where appropriate. Maps and drawings must be in ink on plain white paper. You may use a prepared county map for 1-A below.

Suggested Outline

I. The Trade Area

   A. Draw or obtain a map of the county or counties served by your placement grain, feed, seed, or farm supply firm; sketch in the approximate trade area served; and show the location of all competition within 15 miles.

   B. Make a table listing crop production for the *county* and for the State for the last *5 years.* (Corn, wheat, oats, soybeans, grain sorghums, or other grain products)

   C. Make a table listing livestock and poultry numbers for the *county* and for the State for the last *5 years.* (All cattle, dairy, hogs, poultry, sheep, horses, and others)

   D. Present the above information in graph form. Each page should contain *two* graphs showing production in the State at the top and production in the county at the bottom.

II. The Grain, Feed, Seed, and Farm Supply Firm

   A. History of the business
      1. When established
      2. Type of organization
      3. Number of stockholders
      4. Number of employees
      5. Recent changes
      6. Major services performed by the firm and your opinion on how and why these services should be improved or expanded. (Look at the services from the standpoint of need in the trade area.)

   B. Plant Layout. Make a series of detailed scaled drawings showing the location of all equipment and storage areas. Use one drawing for each floor. Be sure to specify dimensions.

   C. Equipment. Make a list of all equipment used in the plant. List type and capacity of each and the motor type and size required to provide power.

   D. Storage. List all storage areas and bins. Give the capacity of each.

   E. Rearrangement. Give your opinion on how the plant could be rearranged to do a better job of serving the customer.
      1. Illustrate with drawings.
      2. Justify these changes in terms of economics.

   F. Products. List the product lines handled by the business. Should any product lines be added? Should any product lines be dropped?

   G. Danger points. List any danger points that should be corrected to protect employees or customers.

III. Your Role in the Firm

A. Jobs you performed in the firm and the percentage of time spent on each job. (This should be a summary of your monthly reports.)

B. What jobs did you enjoy most? What jobs did you dislike?

C. In what areas were you given major responsibility?

D. In what phase of the business do you feel you would best fit? Why?

E. Describe your relationship with other employees.

F. How could on-the-job training have been improved? Consider from the manager's responsibility, the coordinator's responsibility, and your responsibility.

Elevator Trainee Evaluation

(To Be Completed by the Manager)

Check the description that most nearly describes the trainee in each of the seven categories listed below.

QUALITY	Work shows pride in accomplishment.	Excellent workman—needs experience.	Tries hard—shows promise.	Quality often too poor for acceptance.	Work lacks any praiseworthy factors.
ATTITUDE	Wholesome, pleasant, work manners; deeply interested.	Moderate interest in work and associates	Works impersonally—usually loyal	Occasionally antagonizes—lacks tact	Very weak interest—poor relationships.
APPEARANCE	Dressed for the job—always neat and clean	Creates fair impression—usually neat.	Acceptable only—careless in dress.	Creates unfavorable impression—too dressy.	Unsuitable—unshaven, often dirty.
RELATIONSHIP	Accepted—a leader—gets along well.	Usually accepted—developing nicely	Acceptance fair—Personality is poor.	Seldom accepted— lacks leadership.	Domineering—a lone wolf.
RESPONSIBILITY	Seeks new work—very cooperative.	Fair initiative—cooperative—developing.	Cooperative—little initiative	Makes little effort—does only work assigned.	Fails to accept any responsibility.
CUSTOMER ACCEPTANCE	Very well liked—customers consult him	Seems to be liked—trying to please	Few people like him—doesn't care much.	Very little acceptance—no interest.	People dislike him—no acceptance.
INTEREST	Enthusiastic—shows in fellow workers.	Lacks enthusiasm except in certain areas.	Shows some interest but not for long.	Little imagination— no desire to progress.	Works for pay only—no interest.

STUDENT'S NAME ____________________ MANAGER'S SIGNATURE ____________________

Please circle the grade you would give this student on his overall performance. Compare the student's performance with other young men just starting in elevator work.

A B C D F

Please list your comments on the back of this form.

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